Malnutrition in Infants and Young Children in Latin America and the Caribbean: Achieving the Millennium Development Goals

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Cover photo: UNICEF / Peru. The photo depicts one stunted and one normal child from Andahuavlas, Peru. The child on the left is 2 years and 9 months old and 78.3 cm and stunted. The child on the right is 2 years and 6 months old and of normal height for her age (86.4 cm).

Presentation

The fight against malnutrition is essential to achieve nearly all of the Millennium Development Goals (MDGs) and is occurring in a politically important and strategic moment in history. Many Member States are committed at the highest political levels to eradicate stunting in young children. This commitment reflects an understanding of the importance of young child nutrition for physical and mental health throughout life, and for social and economic development generally. It also reflects the knowledge that there are evidence-based cost-effective preventive interventions, which will result in increased physical growth, cognitive development, educational achievement and economic productivity.

This comprehensive report on the growth of children over the last 20 years in 13 Latin America and Caribbean countries provides a useful tool in the fight against malnutrition. Primary data analysis of nationally representative surveys provides a thorough assessment of the prevalence of malnutrition, age-specific patterns of poor growth, and variations in poor growth within and among countries and among indigenous children. Furthermore, it analyzes trends in malnutrition from the perspective of equity and assesses whether countries are "on track" to meet MDG 1. Lastly, it provides guidance for programs and policies to reduce malnutrition.

Maternal and child undernutrition is the largest single contributor to child mortality and contributes more than one-third of child deaths and more than 10% of the global disease burden. It is my hope that this document will help to orient Member States, development agencies, non-governmental organizations and the donor community on how best to achieve the MDGs related to child mortality and malnutrition.

Mirta Roses Periago
Director

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Executive summary

Maternal and child malnutrition contributes to more than one-third of child deaths and more than 10% of the total global disease burden. Of the nutrition-related factors for child death, stunting, severe wasting and intrauterine growth restriction constitute the largest risk factor. Therefore, reducing growth retardation in infants and young children is essential to achieve the Millennium Development Goals (MDGs) related to child survival (MDG 4) as well as the eradication of extreme poverty and hunger (MDG 1).

To achieve the MDGs, analysis of data on weight, length/height and weight-for-length/height is necessary to identify both the optimal time to intervene to prevent growth retardation and to identify the most appropriate interventions. We applied the new WHO Child Growth Standards to multiple data sets from Bolivia, Brazil, Colombia, the Dominican Republic, El Salvador, Guatemala, Haiti, Honduras, Mexico, Nicaragua and Peru, and to a single data set from Ecuador. We also analyzed published data from Argentina and Mexico. The results provide new insights into the causes of malnutrition, its magnitude and the age at which children are most vulnerable. We also identify policy and programmatic interventions to speed its eradication.

The application of the new WHO Standards results in increased prevalence of stunting and overweight and decreased prevalence of underweight, compared with the previous (NCHS) reference. Though the prevalence estimate of wasting is largely unchanged for children over 12 months of age, the prevalence of wasting among children less than 1 year of age (particularly 0-5 months of age) increases with the use of the WHO Standards. The application of the WHO standards also reveals the previous underestimation of stunting across all age groups when the NCHS reference was used. Compared with the prevalence under the NCHS reference, the prevalence of stunting is 2.4 to 6.9 percentage points higher using the WHO Standards. Stunting is the most prevalent growth problem in the Region, with prevalence ranging from 11.8 in the Dominican Republic to 54.5 in Guatemala. The high prevalence of stunting relative to the low prevalence of underweight is striking; stunting far exceeds underweight in all countries from a minimum of 1.6 times in Haiti to a maximum of 5.4 times in Bolivia. The largest disparities between underweight and stunting prevalence are observed in the Andean countries (Ecuador, Bolivia and Peru), where the prevalence of stunting is roughly four to five times that of underweight. Approximately half of the countries had a prevalence of wasting less than what would be expected in a normal population. Overweight is an increasing problem and the WHO Standard highlights the previous underestimation of overweight among children over 12 months of age. In all countries, the prevalence of overweight ranges from 4% to 9%.

In all countries of the Region, children on average fail to grow in length and weight according to the WHO Standards, and they do so in a remarkably similar age-specific pattern, despite vastly different prevalences of underweight and stunting. Faltering in both weight and length begins at birth and continues for approximately the first 24 months of life. However,

whereas weight-for-age stabilizes thereafter at approximately -0.5 Z-scores, length/height-for-age stabilizes at -1.5 Z-scores. As a result, weight-for-length/height Z-scores are positive and stabilize at approximately 0.25 Z-scores, illustrating the right-shift in the distribution of weight-for-length/height toward overweight. Thus, the "average" child in the region, with the exception of the Haitian child, is short and chubby. The age-specific pattern of growth retardation in weight and length clearly show that the first 24 months of life represents a critical window of opportunity to intervene to prevent postnatal growth retardation.

Overall country prevalence estimates mask enormous within-country differences, which in percentage points are largest for stunting. For example, in Peru, the overall mean prevalence of stunting was 29.8%, but ranged from a low of 6.7% in Tacna to a high of 60.1% in Huancavelica. Detailed country-specific analyses are provided in the Appendix.

Similarly, ethnic disparities are also readily apparent among the under-5 population, with indigenous children being roughly two times more likely to be stunted than non-indigenous children. Underweight follows this same pattern (i.e., affecting indigenous children disproportionately), whereas overweight does not consistently affect one group more than another.

The prevalence of underweight and stunting decreased during the past two decades, although on average less than a percentage point per year for most countries, and the prevalence of stunting remains high. Of concern is the finding that the most recent surveys in a few countries show that the already slow pace of decline has further slowed or reversed course. Stunting affects poor children far more than rich ones and with the exception of Brazil, the Dominican Republic and Mexico, trends over the past 20 years show that little has been done to reduce this inequity. The prevalence of wasting overall remained similar across the past two decades, with a few exceptions. Overweight prevalence increased, although in several countries, the sharpest increases occurred during the earlier part of the past two decades, with more recent data showing a plateau or decrease in overall overweight prevalence.

The best epidemiological indicator for assessing malnutrition is stunting because it reflects the accumulated, permanent and long-term effects of insults to young child nutrition; these include poor breastfeeding and complementary feeding practices, including feeding of nutrient-poor foods and repeated infections. Underlying these direct causes of malnutrition are poverty and its social and economic determinants. Unfortunately, the official indicator for monitoring achievement of MDG 1 (reducing the prevalence of malnutrition by half between 2000 and 2015) is underweight. The choice of indicator has important implications for determining whether countries are estimated to be "on track" to meet MDG 1. If stunting is used, only four of the 10 countries (the Dominican Republic, Mexico, Nicaragua and El Salvador) are estimated to be on track. Colombia is also estimated to achieve the goal if it once again achieves annual percentage point declines like those achieved in earlier years, before their rate of decline slowed down. The remaining five countries (Bolivia, Guatemala, Haiti, Honduras and Peru) are not estimated to be on track to reach the goal. If underweight is used as the indicator, nine of the 10 countries analyzed (all countries except Haiti) are estimated to be on track to meet the goal[1].

1 Only a single data point is available for Argentina and Ecuador; therefore, estimates could not be made.

The major public health challenge is to improve linear growth, that is, reduce stunting. The large prevalence of stunting relative to underweight suggests that energy or "the amount food" is not the main dietary problem, but rather the characteristics of the diet (the types of food), the appetite of the child (which can be affected by both nutrition and health status) and caregiver feeding behaviors. The prevalence of diarrhea peaks in the first two years of life and also negatively affects growth through its pernicious effects on appetite and nutrient absorption and increasing metabolism and nutrient loss. The high frequency of infection common in many countries prevents periods of "catch-up" growth, during which a child could regain an adequate growth trajectory. Therefore, appropriate prevention and treatment of common early childhood illnesses is also critical to improving growth.

Prevention of stunting requires both short- and long-term approaches. In the long run, improvements in the underlying social and economic determinants of malnutrition are necessary. These include improving maternal education, economic opportunities to grow or acquire appropriate foods for infants and young children, water and sanitation services and access to quality health services and women's empowerment. Reducing stunting in the short-run, requires protecting, promoting and supporting breastfeeding, and providing counseling and education about complementary feeding (in the absence of food insecurity) and/or provision of appropriate complementary foods with counseling, reducing the frequency and duration of respiratory infections and diarrhea and promoting increased intake after illness for "catch-up" growth.

To reduce the gross inequities in the Region, the short- and long-term interventions described above must be targeted to the communities with the highest prevalences of stunting, who are often the most difficult and expensive to reach. Targeting of pregnant women and infants and young children in these communities should be preventive and universal in nature as by the time stunting is diagnosed the "window of opportunity" for its prevention may have passed. The greatest challenge will be translating the political commitment to reduce inequities into policies and programs that engage the poorest communities from the very beginning as key stakeholders in developing the solutions to their problems. Political rhetoric must be transformed into concrete actions that reach all pregnant women and young children. Investing in and improving monitoring and evaluation programs will also be essential to monitor progress, make necessary policy and program adjustments, and assess impact and the cost of the results achieved.

To achieve adequate coverage, the interventions described above must be integrated into primary health care and programs for pregnancy, maternity, neonatal and care of the young child. Improving infant and young child nutrition must be a priority for all health personnel-- not limited to the domain of nutritionists-- and they must have the knowledge and technical skills to appropriately counsel mothers on breastfeeding and complementary feeding, manage feeding and nutrition problems and treat illnesses that lead to malnutrition. MDGs 4 and 1 will only be achieved when early childhood feeding and nutrition become an integral part of all maternal, neonatal, infant and child strategies to prevent mortality and promote optimal health and development.

Acronyms

BFHI	Baby Friendly Hospital Initiative
CDC	Centers for Disease Control and Prevention
DHS	Demographic and Health Surveys
IMCI	Integrated Management of Childhood Illnesses
MDG	Millennium Development Goal
MGRS	Multicenter Growth Reference Study
NCHS	National Center for Health Statistics
SD	Standard Deviation
SES	Socio-economic Status
UNICEF	United Nations Children's Fund
WHO	World Health Organization

Introduction

Maternal and child under nutrition contributes to more than one-third of child deaths, more than 10% of the total global disease burden and is the single largest contributor to child mortality. [1] [2] Of the nutrition-related factors for child death, stunting, severe wasting and intrauterine growth restriction constitute the largest risk factor. Therefore, reducing infant and young child growth retardation is directly related to achievement of the Millennium Development Goals (MDG) related to child survival (MDG 4) and the eradication of extreme poverty and hunger (MDG 1). Because of the far reaching effects of early childhood nutrition on health and cognitive development, it is also relevant to the achievement of the MDGs related to universal primary education, promotion of gender equality and empowerment of women, improvement of maternal health and combating HIV/AIDS.

Despite improvements in young child nutrition that have taken place in many countries, dramatic increases in the price of food and fuel challenge our collective commitment to better child nutrition. While young children consume only small amounts of food, the quality of the food they consume is extremely important for their nutrition and physical and mental health.[3] While breast milk alone is sufficient for the first 6 months of life, in addition to continued breastfeeding young children later require nutrient-rich foods that provide the vitamins, minerals, proteins and essential fatty acids necessary for optimal development. Nutrient-rich foods, often animal source foods, are expensive relative to staple foods.

To make progress toward achieving the MDGs, identifying both the optimal time to intervene to prevent growth retardation and the most appropriate interventions is needed. This process is informed by the analysis of trends in child growth--weight, length/height and weight-for-length/height. Not only is the window of opportunity for preventing early childhood growth retardation narrower than previously believed[4], but several public health interventions have been demonstrated to be effective[5-7] as well as cost-effective [8] in promoting feeding behaviors known to be associated with improved nutrition.

Objectives and goal

The present document has two objectives and one goal. The first objective is to provide a baseline assessment that reflects not only how far we have come to reduce child malnutrition but that also informs us on how far we still have to go to reduce inequities and ensure that every newborn has the same opportunities to grow and develop to their maximum potential. The second objective is to provide guidance on priority actions needed during the "window of opportunity" to improve young child nutrition so that the Region's most vulnerable citizens can achieve their physical and mental development and fully benefit from social investments in their education. Our goal is to orient national governments, development agencies, the donor community and non-governmental organizations on how best to achieve the MDGs related to child mortality and malnutrition and invest scarce technical and financial resources for this purpose.

Target audience

Our target audience for this document is intentionally broad for several reasons. To bring nutrition into the center of discussions on how to improve overall human development and social well-being, a wide range of individuals including government officials, development agencies, donor agencies and nongovernmental organizations interested not only in health, but also social and economic development, need to be involved in this process. Different individuals involved in health and social and economic development will need varying levels of information about the topics we discuss. For example, some will be more interested in the analysis of trends and predictions for achieving the MDG related to malnutrition. Others will be interested in the epidemiological analysis related to the timing of growth failure and how to best assess malnutrition. Others will be interested in our recommendations on how to accelerate the pace of reducing child malnutrition and reducing inequities. All will likely benefit from our review of malnutrition in the region and its causes and, most importantly, priority actions for its reduction. It is our hope that many will be interested in the entire document as a way to better grasp the obstacles and opportunities before us to improve young child nutrition.

Organization of document

In the first section of this report, we discuss the causes and consequences of poor growth, both nutritional and non nutritional. In the second section, we describe how malnutrition is measured and the relevance of the new WHO Child Growth Standards to appropriately estimating poor growth. We also describe the methods used for the analysis of nationally representative growth data from 13 countries in the Region (Argentina, Bolivia, Brazil, Colombia, Dominican Republic, Ecuador, El Salvador, Guatemala, Haiti, Honduras, Mexico, Nicaragua and Peru), presented in the following sections. In the third section, we present prevalence estimates of malnutrition (stunting, wasting, underweight and overweight) within and among countries and how the estimates change when the new WHO Standards are applied, as compared with the previously used U.S. National Centers for Health Statistics (NCHS) Child Growth Reference. In the fourth section, we present trends in malnutrition (overall and by subgroups) as well as the age-specific patterns of poor growth for countries with surveys from multiple time points. We also present an analysis of progress towards achieving MDG 1. Lastly, we discuss the implications of preceding sections for policy and programs to prevent malnutrition.

1. Causes and consequences of poor growth

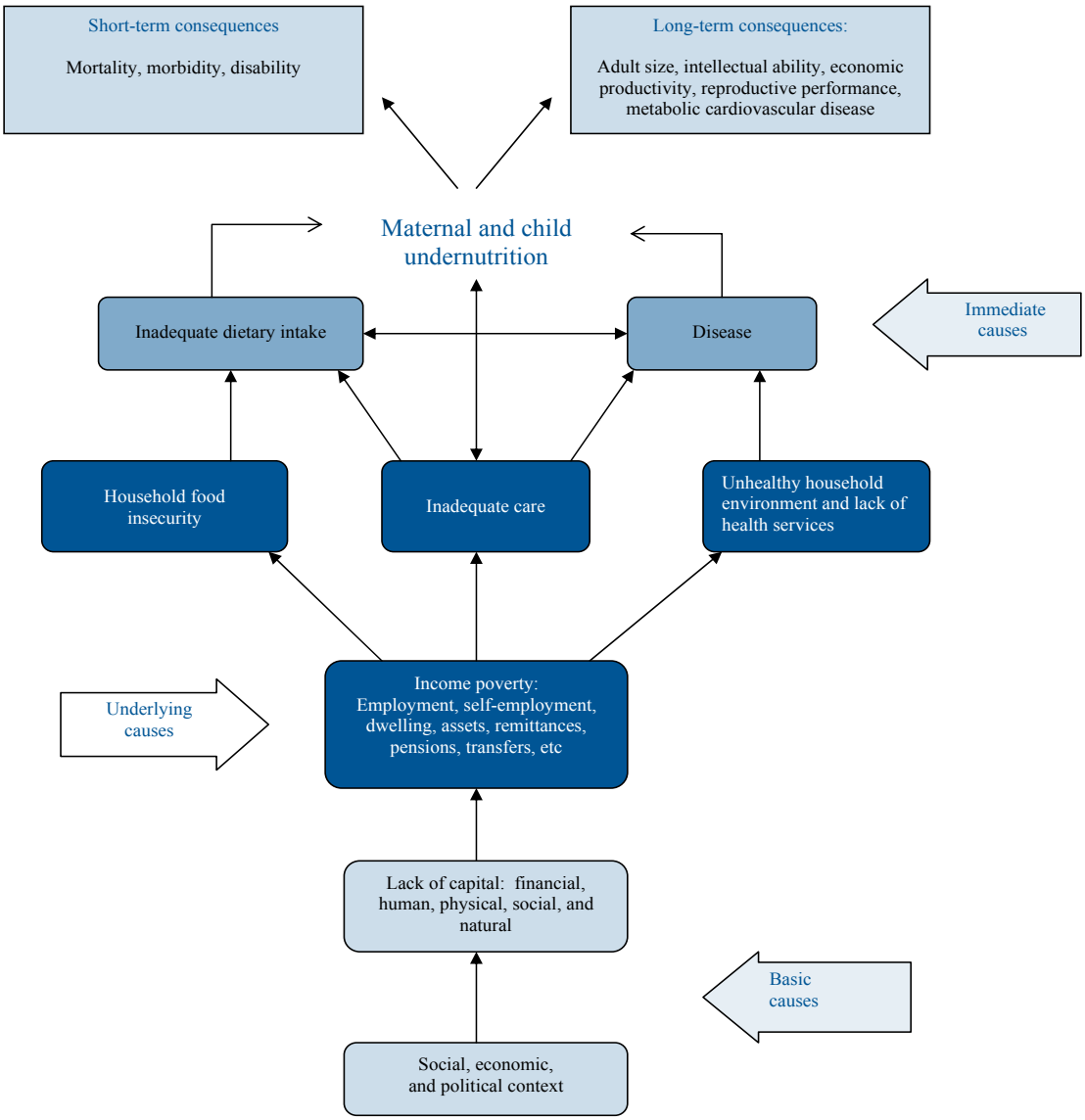
Poor growth is both a cause and consequence of poverty. [9] Longitudinal studies have shown that in adulthood, the accumulated effects of childhood malnutrition affect worker productivity, income and health. [10] [11] The accumulated effects of poor growth during childhood are also intergenerational; infants born to women who themselves were malnourished early in life are smaller than infants born to better-nourished women [12] and intrauterine growth retardation may limit post-natal growth.[13]

The most proximal causes of poor growth are inadequate breastfeeding and complementary feeding practices [14] and infectious disease. [15] Inadequate energy and nutrient intake results from inappropriate feeding practices[16], dietary quality of the complementary feeding diet [17] and among the extremely poor or marginalized, household food insecurity. Although many households in Latin America and the Caribbean likely have adequate resources to provide enough food to meet the energy requirements of infants and young children, many do not have the resources to provide the types of food that are needed to meet their micronutrient requirements (animal source foods and/or fortified foods). This is most true for the nutrients identified as "problem nutrients", which include iron, zinc and vitamin B6 in most developing country populations and riboflavin, niacin, calcium, vitamin A, thiamine, folate and vitamin C in certain populations. [3] Though intake of these nutrients may be high, frequently the bioavailability of the nutrients in the diet is poor (e.g. iron and zinc from plant sources), so that overall absorption is low. The best source of many of these nutrients is animal flesh, which can be prohibitively expensive for many families to purchase on a regular basis. Also, even if the household has enough food to provide for infant and young child energy requirements, this does not mean that infants and children actually meet them. Even in studies where energy intake appears to be inadequate, young children consume less food than offered [18], possibly because of poor appetite, characteristics of the diet (e.g., taste and texture) and feeding practices.

Diarrheal illness is also important in the etiology of growth failure [19] as it reduces appetite and intestinal absorption of energy and nutrients. [20] Furthermore, the interaction between inadequate nutrient intake and diarrhea is such that their simultaneous presence affects growth in a manner far greater than the simple additive effects would predict. [21-23]

Both inadequate nutrient intake and infectious disease result from underlying social and economic conditions in the household, community and country. UNICEF's conceptual model in Figure 1 shows the underlying basic, underlying and immediate causes and consequences of maternal and child malnutrition. Importantly, it shows that early childhood malnutrition has both short and long-term consequences and implications for health, [1] with long-term implications for educational achievement, life-time earnings and the development of human capital.[10]

Figure 1. UNICEF Conceptual Model of the Causes of Malnutrition



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2. Analytical framework

Measurements of weight and length/height of infants and young children are widely used to assess growth. [24] In this section, we describe these indices, the new WHO Child Growth Standards and the methods used in our analysis.

2.1 Anthropometric indices of poor growth

Anthropometric indices are combinations of measurements of weight and length and in children the most frequently used indices are weight-for-age, length/height-for-age and weight-for-length/height. Increasingly, Body Mass Index (BMI), calculated as weight/height^2, is being used in older children, adolescents and adults to assess underweight and overweight/obesity.

Anthropometric indices are generally used in relation to international reference values or standards that provide an assessment of optimal growth.[25] An exception would be body mass index (BMI) which is useful without involving a reference or standard. In population-based studies, indices are most often expressed in Z-scores, which is the deviation of an observed value from the median value of the sex- and age-specific reference population divided by the standard deviation of the reference population or

$$\text{Z - score} = \frac{\text{(observed value) - (median of reference population)}}{\text{standard deviation of reference population}}$$

The key advantage of using Z-scores is that for population-based studies, the mean and standard deviation can be calculated. Z-scores also have the advantage of detecting changes at extremes of a distribution.

The commonly used anthropometric indicators of stunting, wasting, underweight and overweight are calculated from the indices described above. Prevalence estimates for these indicators are based on the concept that in a well-nourished population, for a given age, the distribution of children's length/height and weight will approximate a normal distribution. Thus, 68% of children will have a height or weight within 1 standard deviation (SD) of the median for that age and 95% of children will have a height or weight within 2 SD of the median for that age. Only about 4% will have a height or weight that is outside of 2 SD from the median for that age. Therefore, prevalence estimates <-2 SD and > 2 SD indicate deviations from the norm.

The definitions of the most common anthropometric indicators for describing the growth of young children are as follows: [24]

- *Stunting* is defined as length/height-for-age less than -2 SD of the median of the reference population and results from the failure to grow adequately in length/height in relation to age. Severe stunting is defined as length/height-for-age less than -3 SD. Stunting reflects the accumulated effects of inadequate nutrient intake (though not necessarily inadequate energy intake) and/or repeated episodes of illness, especially diarrhea, and their interaction. Although stunting is often referred to as chronic malnutrition, the term is misleading in that it implies a continuing condition with on-going effects, which is not true after the first

2 years of life. Between 2 and 5 years of age, the velocity of growth in length of children in the Region is similar to that of well-nourished children in the rest of the world, including Norway and the United States. However, deficits in length that occurred during the first 2 years are rarely recouped, resulting in permanently stunted children.

- *Wasting* is defined as weight-for-length/height less than -2 SD of the median of the reference population and results from the failure to gain weight adequately in relation to length/height. Severe wasting is defined as weight-for-length/height less than -3 SD and is a life threatening condition. Wasting reflects recent shortage in energy intake and/or recent acute illness, especially diarrhea. It is a useful indicator for both clinical and epidemiological purposes as it identifies a currently malnourished child or population of children.
- *Underweight* is defined as weight-for-age less than -2 SD of the median of the reference population. Severe underweight is defined as weight-for-age less than -3 SD. It reflects either chronic or acute malnutrition or both. Underweight is an "ambiguous" indicator, particularly after the first year of life, in that whether or not an underweight child is malnourished depends on his weight-for-length/height relationship. A child classified as "underweight" could have a normal weight-for-length/height relationship because the child is stunted. In contrast, a "normal weight" child may be classified as overweight, if stunted. Although weight is a very useful indicator clinically to assess the well-being of an individual child, as ill children frequently lose weight, stunting is a far more useful indicator for epidemiological purposes.
- *Overweight* is defined as weight-for-length/height greater than 2 SD of the median of the reference population. [24] Obesity is defined as weight-for-length/height greater than 3 SD of the median of the reference population.

Measurement of both weight and height (and calculation of the associated indicators) will give the most complete picture of the nutritional status of a population. However, because of the relative ease of accurately measuring weight versus accurately measuring length/height, frequently underweight is used as indicator to reflect levels of "malnutrition" in a population. Underweight was chosen as the official indicator for monitoring progress towards the goal of MDG 1 to reduce levels of malnutrition by half. Because weight is much more labile than height and losses can be recouped at any point in life, solely monitoring the prevalence of underweight will significantly underestimate the true prevalence of malnutrition, especially because stunted children are often of normal weight and some are overweight. In comparison, stunting is cumulative and largely irreversible after 24 months of age. Therefore, the best indicator for assessing child malnutrition is stunting, because it reflects the cumulative and permanent effects of early childhood malnutrition and is more directly linked with long-term consequences of educational achievement and economic productivity. [10] Accordingly, stunting was the preferred indicator in assessing childhood malnutrition in the recent series in *The Lancet* on Maternal and Child Undernutrition.[1]

2.2 The WHO Child Growth Standards

In April 2006, the World Health Organization (WHO) released new growth standards for children under the age of 5 years. [26] These

standards resulted from a longitudinal and multicenter study involving more than 8,400 breastfed children from Africa, Asia, Europe, North America, South America and the Middle East. The new standards were developed to replace the growth reference developed by the NCHS and that has been used in most countries throughout the world, including those in Latin America and the Caribbean. The NCHS reference was recommended for use by the WHO in 1977 and is commonly known as the NCHS/WHO reference.[1]

The WHO Multicenter Growth Reference Study (MGRS), from which the new growth standards were developed, resulted from the observation that the growth of healthy breastfed infants deviated from the NCHS international reference. [27] Conceptually, the new WHO Standards differ from the NCHS reference in that, rather than describing how children grow at any given point in time, it represents how children grow when nutrition, care and health conditions enable them to achieve their genetic potential. Therefore, protocols for the MGRS were based on a prescriptive approach, which sought to describe growth of children living in optimal conditions for growth. Conditions for optimal growth were defined by three criteria: 1) optimal nutrition or breastfeeding and complementary feeding according to the WHO recommendations[2]; 2) unconstrained environment in terms of environmental sanitation and absence of exposure to tobacco smoke; and, 3) adequate health care, including a completed immunization schedule and routine pediatric care.

In addition to its prescriptive approach in assessing growth, there are a number of innovative aspects of the new WHO Child Growth Standards that merit attention. It uses the breastfed child as the model and norm for optimal growth. It is based on an international sample that represents most major ethnic groups. It provides reference data to evaluate growth velocity. The prescriptive focus recognizes the need for norms that describe how children grow under optimal conditions rather than describing how children grow at a given time and place. Most countries in Latin America and the Caribbean have implemented or are in the process of implementing the new WHO Standards.

2.3 Methods

We applied the new WHO Child Growth Standards to anthropometric data provided by the U.S. Centers for Disease Control and Prevention (CDC) or downloaded from the web with permission from the Demographic and Health Survey (DHS) website (*http://www.measuredhs.com/accesssurveys/start.cfm*).[3] All nationally representative publicly available datasets with anthropometric data for countries in the Latin America and Caribbean region were included. Multiple data sets were available for 10 countries (Bolivia, Brazil, Colombia, the Dominican Republic, El Salvador, Guatemala, Haiti, Honduras, Nicaragua and Peru) and a single data set was available for Ecuador. The surveys are identified by their country name and the year in which the survey was performed. The most recent Peru survey,

1 In this report, the NCHS/WHO reference will be referred to as the NCHS reference to distinguish it from the new WHO Standards.

2 The recommendation for the duration of exclusive breastfeeding when the MGRS began was 4 to 6 months and this was the recommendation used. Subsequently, the WHO recommendation was changed to 6 months.

3 To ensure comparability across data sets and countries and avoid biases that could be introduced when clinic-based data are used, only those countries with nationally representative (household based) surveys were included in the analysis. Nonetheless, extremely valuable lessons can be learned from countries with excellent health-based nutrition surveillance systems, such as Chile. Chile was also very successful in reducing stunting through addressing its social and economic determinants and attention to young child feeding and nutrition as an integral part of primary health care.

Table 1. Year and sample size of nationally representative surveys used in the analysis

Country	Year	Sample size, children 0 to 60 months of age[1]
Argentina[2]	2006	32,474
Bolivia	1989 1994 1998 2003	2,681 3,008 6,420 9,925
Brazil	1986 1996	1,190 4,364
Colombia	1986 1995 2000 2005	1,335 4,561 4,239 14,007
Dominican Republic	1986 1991 1996 2002	1,972 3,284 3,841 11,170
Ecuador	2004	5,224
El Salvador	1993 1998 2002/03	3,518 6,590 5,294
Guatemala	1987 1995 1998/99 2002	2,250 8,792 4,055 6,505
Haiti	1994/95 2000 2005	2,874 6,502 2,987
Honduras	2001 2005	5,664 10,320
Mexico[3]	1988 1999 2006	6,937 7,590 7,707
Nicaragua	1997/98 2001	7,200 6,138
Peru[4]	1992 1996 2000 2004/08	7,874 15,354 11,884 2,347

1 Number of observations for weight-for-age calculations (represents maximum sample size) for children 0-60 months of age.

2 Results are from final report, analysis not done from original data. Represents data of children 6 to 60 months of age. Source: Encuesta Nacional de Nutrición y Salud (ENNyS), Documento de Resultados. Ministerio de Salud de la Nación. Buenos Aires, Argentina. 2006.

3 Results are from final report, analysis not done from original data. Represents data of children 6 to 60 months of age. Source: González de Cossío T, Rivera J, Monterrubio E, González D, Unar M. Revista de Salud Pública de México, In Press.

4 For regional estimates only, data from the 2005, 2007 and 1st trimester amplified survey of 2008 were used (n=9047 for weight and 8969 for height).

Peru 2004-2008, is an ongoing survey, being completed in several cycles. The anthropometric data used in these analyses were collected in 2005, except for regional estimates for which data collected in 2005, 2007 and the 1st trimester of 2008 were used. Data from Argentina and Mexico were taken from published reports [28, 29] (Table 1). For the DHS datasets, starting in approximately 1999 (with the fourth phase of surveys), all children under 5 years of age in a household, rather than only those of the respondent woman of reproductive age, were measured.

All analyses were done using SAS for Windows (version 9.1). Individual Z-scores for the three indices (weight-for-age, length/weight-for-age and weight-for-length/height) using the NCHS reference were included as variables in the DHS and CDC datasets. Individual Z-scores for four anthropometric indices (weight-for-age, length/height-for-age, weight-for-length/height, as well as BMI-for-age) using the WHO Standards were calculated using the SAS macro downloaded from the WHO website (*www.who.int/childgrowth/software/en/*). Summary statistics were performed to calculate the overall prevalence of underweight (percentage less than -2 SD from the median for weight-for-age), stunting (percentage less than -2 SD from the median for length/height-for-age), wasting (percentage less than -2 SD from the median for weight-for-length/height) and overweight (percentage greater than 2 SD from the median for weight-for-length/height) and mean z-scores overall and within particular subgroups (e.g. urban vs. rural, male vs. female, age categories, maternal education categories) for each survey available, using both the NCHS reference and the WHO Standards. In addition, results from the analyses of anthropometric data of the 2006 National Nutrition Survey in Argentina and the 1988, 1999 and 2006 National Nutrition Surveys in Mexico that have published prevalence estimates with the new WHO Child Growth Standards, are included for comparison in many analyses; original data from these survey were not analyzed by the authors. For the most recent survey data available for each country, mean Z-scores at each month of age were used to calculate five-month moving averages to smooth growth patterns by age. Changes in the prevalence of underweight, stunting, wasting and overweight over time were assessed by calculating the annual change in growth (in percentage points), to adjust for differences in the length of time between surveys among countries. We also used the annual rate of change for underweight and stunting to assess each country's progress to achieving MDG 1. Using the survey date closest to 2000 as the baseline (range 1998-2002), both the predicted trend (based on the trend in previous years) and target trend (based on the goal of reducing malnutrition by half by 2015) for the prevalence of stunting and underweight were calculated.

Trends over time in stunting, underweight, wasting and overweight from the perspective of equity, were analyzed. Several demographic and socioeconomic variables were considered for this analysis, the most important criteria being the comparability of the variable(s) during the approximately 20-year period examined and the availability of the variable(s) in both the CDC and DHS data sets. The variable of maternal education best fit these criteria, as it was consistently collected across survey years in both the CDC and DHS datasets. Maternal education was also generally well-correlated with the indicator of socioeconomic status in the surveys we analyzed. Trends were examined by the highest level of maternal education attended: none, primary, secondary and higher.

We also assessed the changes in stunting prevalence over time by regional "wealth index". For both CDC and DHS a measure of socioeconomic status is provided for each

country. DHS surveys contain a "wealth index" variable, which is a composite measure based on household ownership of selected assets, housing materials, water access and sanitation facilities. This composite score is standardized and divided into country-specific quintiles of "poorest", "poorer", "middle", "rich" and "richest". CDC surveys provide a "socioeconomic (SES) index" variable, divided into three categories of "high", "middle" and "low". Where available, we calculated the mean wealth or SES index for each region in the most recent survey of each country and plotted that variable against the change in stunting prevalence for each region between the earliest and latest surveys available.

To calculate the approximate total number of malnourished children, data from the United Nations World Population Prospects was used. [30] The total number of children under age 5 years from the year closest to the year of each survey was multiplied by the prevalence of stunting or underweight to obtain estimates of the total number of stunted and underweight children, respectively.

3. Prevalence of malnutrition

Application of the new WHO Child Growth Standards provides new insights into the causes of malnutrition, its magnitude and the age at which children are most vulnerable to becoming malnourished. In particular, it renews attention to the large difference between the prevalence of stunting and underweight and focuses attention on the linear growth of children. [31] Linear growth is not only predictive of child short- and long-term well being, but also has important implications for social and economic development.[10] In this section, we describe the differences in prevalence estimates that result from applying the NCHS reference versus the new WHO Standards. We also describe age-specific patterns of poor growth, geographic variations in poor growth, patterns of growth among indigenous children and estimate the number of malnourished children in the countries analyzed.

3.1 Changes in prevalence estimates between NCHS and WHO Child Growth Standards

Compared with the NCHS reference, applying the new WHO Child Growth Standards results in increased prevalence of stunting and overweight and decreased prevalence of underweight (Table 2, Figure 2). The prevalence estimate of wasting is largely unchanged for children greater than 1 year of age; in contrast, in younger children (especially between 0 and 5 months) the WHO Standards reveal that wasting is a problem in this group. The prevalence of stunting increases when applying the new WHO Standards for two reasons. Firstly, breastfed healthy children used in constructing the Standards are slightly taller (about 1 cm) than the mostly formula-fed children in the NCHS reference. Secondly, the NCHS reference, which linked two different datasets at 24 months of age, had a large disjuncture. The magnitude and nature of this disjuncture gave the erroneous impression that the prevalence of stunting improved after 24 months and lowered the overall estimated prevalence. The latter reason explains most of the increase in stunting prevalence. Therefore, the increase in stunting prevalence does not mean that stunting prevalence has increased, but rather, because of intrinsic problems in the NCHS reference, the prevalence of stunting was previously underestimated. Application of the new WHO Standards to all surveys does not change rankings (lowest to highest) of countries with respect to any of the anthropometric indicators nor within countries does it change the interpretation of trends. In percentage points, the largest change is in the prevalence of stunting, which ranges from an increase of 2.4 percentage points in El Salvador to 6.9 percentage points in Haiti (2005) (Figure 2).

The median changes in underweight and overweight prevalence for all children are fairly similar, though in opposite directions from each other. Changes in underweight prevalence ranged from a 1 percentage point decrease in the Dominican Republic to a decrease of 4.9 percentage points in Guatemala. The increase in overweight ranged from 1 percentage points in El Salvador to 3.6 percentage points in Bolivia. Of the indicators, wasting prevalence differed the least between the NCHS reference and the new WHO Standards.

Table 2. Comparison of the prevalence of underweight, stunting, wasting, and overweight using the NCHS Reference versus the WHO Standard

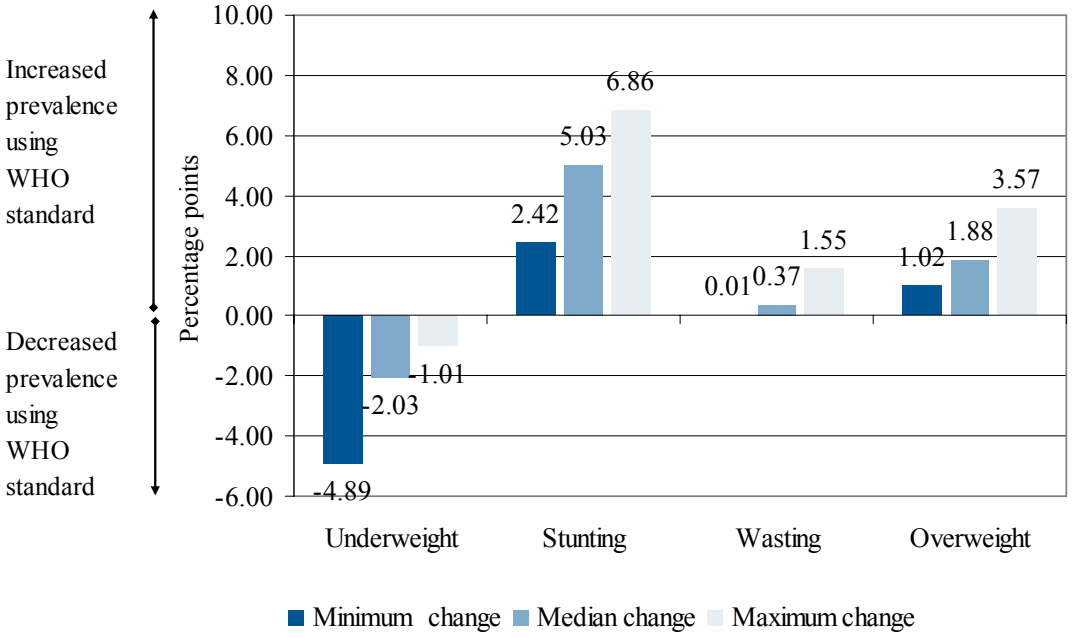
Country, year	Reference	Weight-for-age		Length/height-for-age		Weight-for-Length/height			
		% <-3 SD	% < -2 SD	% <-3 SD	% < -2 SD	% <-3 SD	% < -2 SD	% > 2 SD	% > 3 SD
Bolivia, 2003	WHO	1.63	6.02	11.38	32.63	0.65	1.75	9.30	2.05
	NCHS	1.20	7.56	8.00	26.78	0.33	1.25	5.73	1.70
	Difference (percentage points)	0.43	-1.54	3.38	5.85	0.32	0.50	3.57	0.35
Brazil, 1996	WHO	1.05	4.68	3.93	13.10	0.98	2.90	6.16	1.52
	NCHS	0.57	5.80	2.45	10.43	0.36	2.33	5.05	1.62
	Difference (percentage points)	0.48	-1.12	1.48	2.67	0.62	0.57	1.12	-0.10
Colombia, 2005	WHO	0.85	5.15	3.45	16.26	0.43	1.65	4.26	0.87
	NCHS	0.62	7.05	2.15	12.26	0.10	1.27	3.15	0.79
	Difference (percentage points)	0.23	-1.90	1.30	4.00	0.33	0.38	1.11	0.08
Dominican Republic, 2002	WHO	0.83	4.28	3.87	11.79	0.77	2.27	3.72	2.31
	NCHS	0.52	5.29	2.40	9.00	0.22	1.79	1.57	2.15
	Difference (percentage points)	0.32	-1.01	1.47	2.79	0.55	0.48	2.15	0.16
Ecuador, 2004	WHO	1.43	6.17	8.31	29.31	0.79	2.34	5.27	1.05
	NCHS	1.70	9.65	6.40	23.30	0.89	2.21	3.36	1.39
	Difference (percentage points)	-0.27	-3.48	1.91	6.00	-0.10	0.12	1.91	-0.34
El Salvador, 2003	WHO	0.82	5.49	5.31	20.66	0.25	1.53	5.50	1.23
	NCHS	0.77	9.90	4.71	18.34	0.35	1.35	4.48	1.51
	Difference (percentage points)	0.05	-4.41	0.60	2.42	-0.10	0.18	1.02	-0.27
Guatemala, 2002	WHO	4.00	18.02	27.02	54.47	0.75	1.85	5.71	1.28
	NCHS	3.86	22.90	21.64	49.60	0.53	1.82	4.27	1.42
	Difference (percentage points)	0.15	-4.89	5.39	4.88	0.23	0.01	1.43	-0.13
Haiti, 2005	WHO	7.37	19.21	10.61	30.13	3.26	10.34	4.14	16.11
	NCHS	5.42	21.69	7.51	23.27	1.76	8.79	2.47	10.55
	Difference (percentage points)	1.95	-2.48	3.09	6.86	1.50	1.55	1.67	5.56

Continue >

Continue Table 2. Comparison of the prevalence of underweight, stunting, wasting, and overweight using the NCHS Reference versus the WHO Standard

Country, year	Reference	Weight-for-age		Length/height-for-age		Weight-for-Length/height			
		% <-3 SD	% < -2 SD	% <-3 SD	% < -2 SD	% <-3 SD	% < -2 SD	% > 2 SD	% > 3 SD
Honduras, 2005	WHO	1.64	8.72	9.76	30.15	0.33	1.38	5.90	24.78
	NCHS	1.36	11.43	7.12	24.92	0.13	1.08	4.05	15.52
	Difference (percentage points)	0.28	-2.71	2.64	5.23	0.19	0.30	1.85	9.26
Mexico, 2006	WHO		3.4		15.5		2.0	7.5	
	NCHS		5.0		12.6		1.5	5.1	
	Difference (percentage points)		-1.6		2.9		0.5	2.4	
Nicaragua, 2001	WHO	2.11	7.83	9.04	25.37	0.89	2.33	7.29	2.45
	NCHS	1.61	9.75	6.18	20.18	0.29	1.96	4.82	1.96
	Difference (percentage points)	0.49	-1.93	2.86	5.19	0.60	0.36	2.46	0.49
Peru, 2004-2008	WHO	0.63	5.62	8.89	29.83	0.11	1.16	8.80	1.26
	NCHS	0.43	7.75	5.73	24.22	0.11	1.02	5.57	0.91
	Difference (percentage points)	0.20	-2.13	3.16	5.61	0	0.14	3.23	0.35
Median difference (percentage points)		0.28	-2.03	2.64	5.03	0.32	0.37	1.88	0.16
Largest decrease (percentage points)		-0.27	-4.89	0.00	2.42	-0.10	0.01	1.02	-0.34
Largest increase (percentage points)		1.95	-1.01	5.39	6.86	1.50	1.55	3.57	9.26

Figure 2. Median change and largest decreases and increases in the prevalence of underweight, stunting, wasting and overweight, when the WHO Child Growth Standard is used rather than NCHS reference. All countries, most recent survey only.

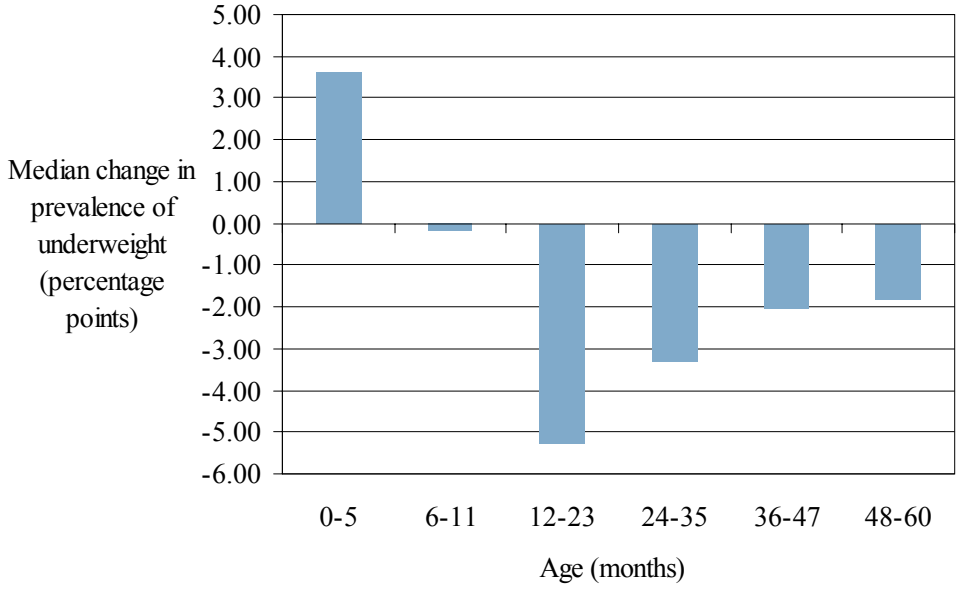


When analyzed by separate age-groups, the direction of changes in the prevalence estimates from using the WHO Standards is generally similar to the direction of changes when all children are analyzed together (Figure 3a-d). However, the magnitude of the difference between the two growth charts for a given prevalence estimate varies by age. Although the prevalence of underweight decreases overall when the WHO Standards are used, during the first half of infancy the prevalence of underweight actually increases. This increase is large and ranges from 1.7 percentage points in Brazil to 13.5 percentage points in Haiti. However, by 12-23 months of age, the prevalence of underweight using the WHO Standards is on average 5.4 percentage points lower than the estimate of underweight using the NCHS reference.

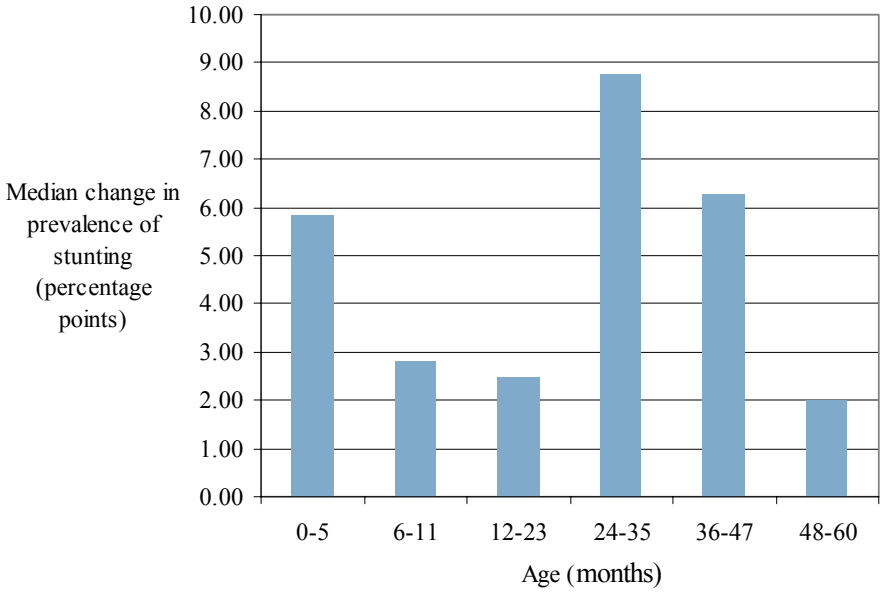
Similarly, when the WHO Standards are used, the prevalence of wasting increases in the first half of infancy, ranging from a 1 to 7 percentage point increase at 0-5 and 6-11 months of age across countries, even though the overall prevalence is largely unchanged. Stunting prevalence is also consistently higher across age groups when the WHO Standards are used in comparison to the NCHS reference, with the greatest increase among the 24-35 month-old age group. In this age group, the increase ranges from 5.0 percentage points in the Dominican Republic to 13.9 percentage points in Haiti. An increase in overweight prevalence using the WHO Standards is only evident starting at approximately 12-23 months of age.

Figure 3a-d. Age-specific changes in the prevalence of underweight, stunting, wasting and overweight using the NCHS reference versus the WHO Child Growth Standard. A positive value indicates that the prevalence estimate is higher when using the WHO Standards compared to the NCHS reference (i.e. represents the amount by which the prevalence was previously under-estimated).

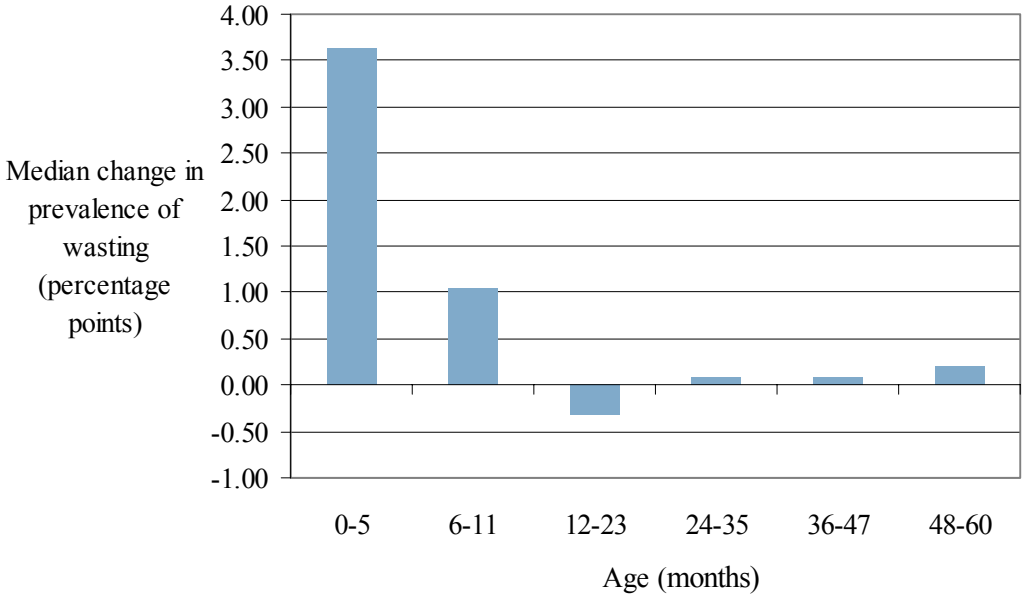
a. Underweight



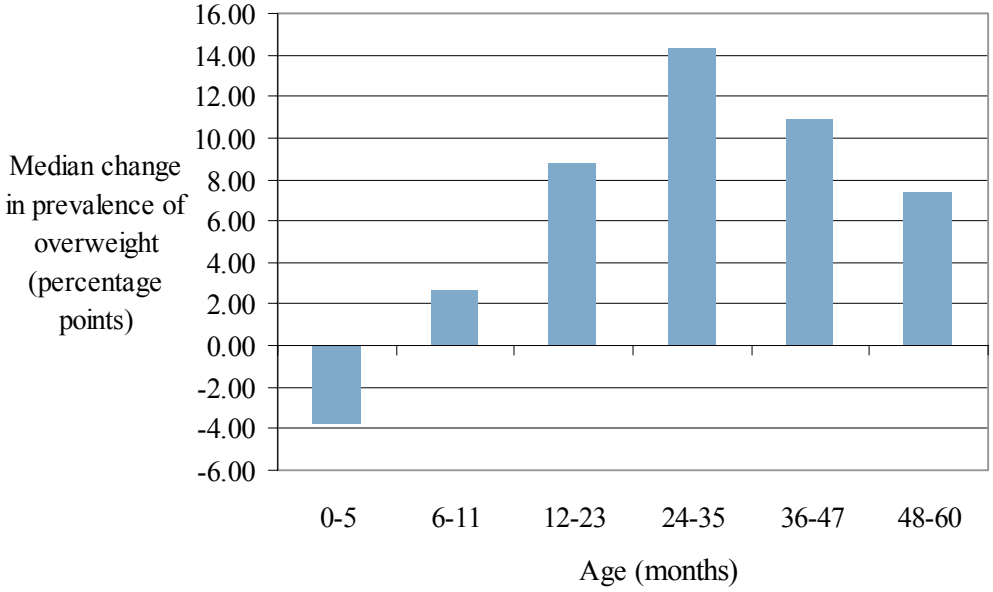
b. Stunting



c. Wasting



d. Overweight



3.2 Prevalence estimates in underweight, stunting, wasting and overweight (WHO Child Growth Standards)

Stunting is the most prevalent growth problem in the Region with a prevalence ranging from 11.8 in the Dominican Republic to 54.5 in Guatemala (Figure 4). (Individual country data are presented in the Appendix.) However, because stunting is cumulative during childhood, (i.e. the highest prevalences are in the older age categories), reporting a prevalence estimate for all children under 5 years of age will underestimate the prevalence in older children and thus inadequately reflect the percentage of children who will remain permanently stunted. Figure 5 shows the prevalence of stunting in each age category (all countries combined) as well as the overall prevalence of stunting when all age categories are combined. As evident in the figure, the overall prevalence of stunting of 23.5% of all under-5 children is below the prevalence of stunting in the last four age categories of ages between 12 and 60 months of age. Similar patterns are found in individual country data (see Appendix). For example, in Guatemala the overall prevalence of stunting is 54.5%; however, among children 36 to 47 months of age, it is 62.7%. In Bolivia, the prevalence of stunting is 32.6% overall, but 41.6% among children 24 to 35 months of age. Thus, the problem of stunting is actually much larger than it would appear when estimated, as conventionally done, using all children less than 5 years in the denominator.

In contrast, the prevalence of underweight is less than 9% in all countries except Haiti (19.2%), Guatemala (18.0%) and Honduras (12.5%). Similarly, for approximately half of the countries, the prevalence of wasting is less than what would be expected in a normal population (2.14%). Haiti had the highest

Figure 4. Prevalence estimates of underweight, stunting, wasting and overweight using the new WHO Child Growth Standards for all countries, most recent survey data.

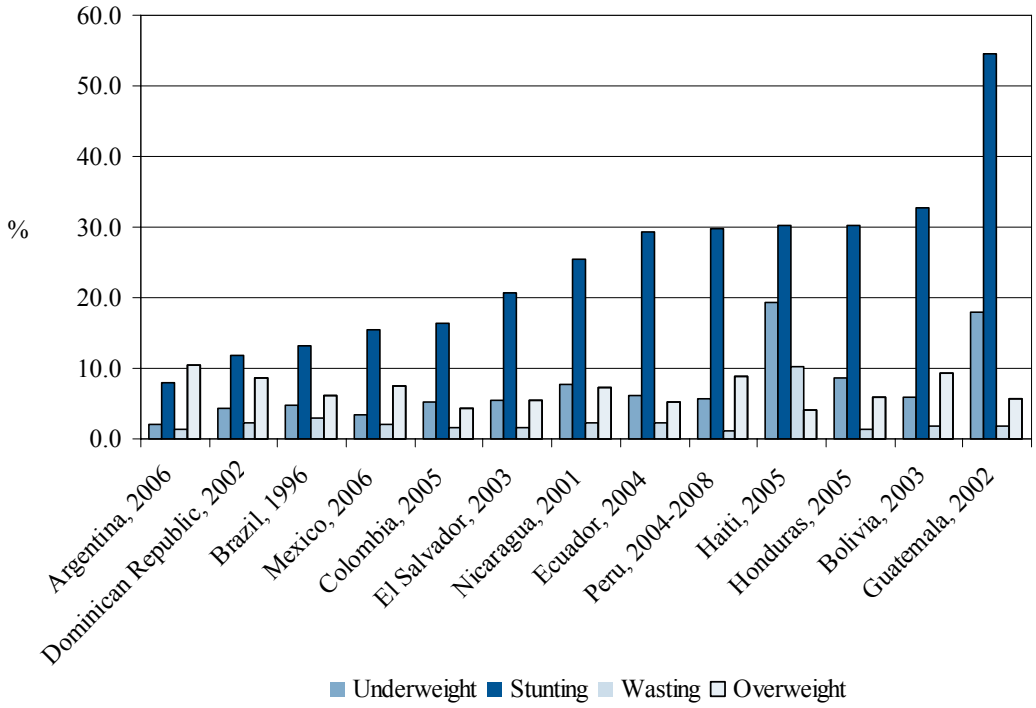
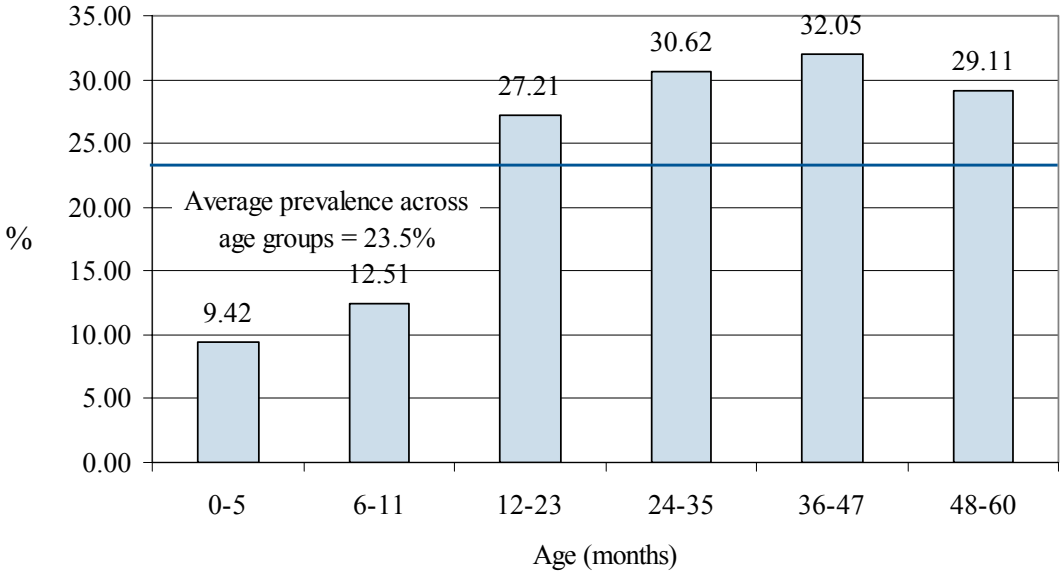


Figure 5. Prevalence of stunting by age group across all countries, most recent survey only: WHO Child Growth Standards. The median prevalence of stunting for all ages (23.7%) is represented by the blue line



prevalence of wasting, 10.3% of under-5 children overall and Honduras the lowest, 1.4% of under-5 children overall. Overweight is an increasing problem, with the prevalence exceeding that expected in a normal population in all countries. It ranges from about 4% in Colombia and Haiti to 9% in the Dominican Republic, Peru and Bolivia.

3.3 Differences in indicators of poor growth

The high prevalence of stunting relative to the low prevalence of underweight is striking (Figure 6). Stunting far exceeds underweight in all countries from a minimum of 1.6 times in Haiti to a maximum of 5.4 times in Bolivia. In general, the largest disparities between underweight and stunting prevalence are observed in the Andean countries (Ecuador, Bolivia and Peru), where the prevalence of stunting is roughly four to five times that of underweight. Mexico also has a large disparity between underweight and stunting, with a level of stunting approximately 4.6 times that of underweight. Stunting also exceeds overweight by at least three times in all countries, with the exception of Haiti. The prevalence of overweight exceeds the prevalence of wasting (Figure 7), by between 2.1 to 5.2 times (in all countries except Haiti) and ranges from a low of 4.1% in Haiti, to a high of 10.4% in Argentina. In addition, the prevalence of overweight is equal to or greater than the prevalence of underweight in approximately half of the countries analyzed (Figure 8). Underweight still far exceeds overweight in Haiti, Honduras and Guatemala by 1.5 to 4.7 times.

3.4 Age-specific patterns of poor growth

Throughout Latin America and the Caribbean, children fail to grow in length and weight in a remarkably similar age-specific pattern, despite vastly different prevalences of un-

Figure 6. Prevalence of underweight vs. stunting by country, most recent survey only: WHO Child Growth Standard.

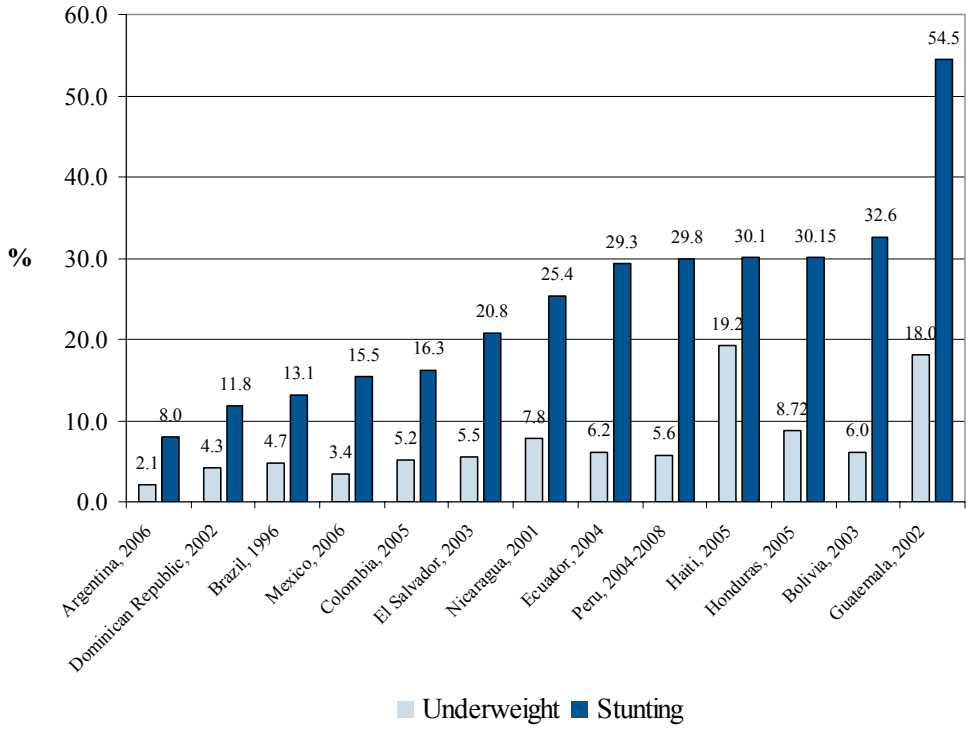


Figure 7. Prevalence of wasting vs. overweight by country, most recent survey only: WHO Child Growth Standard.

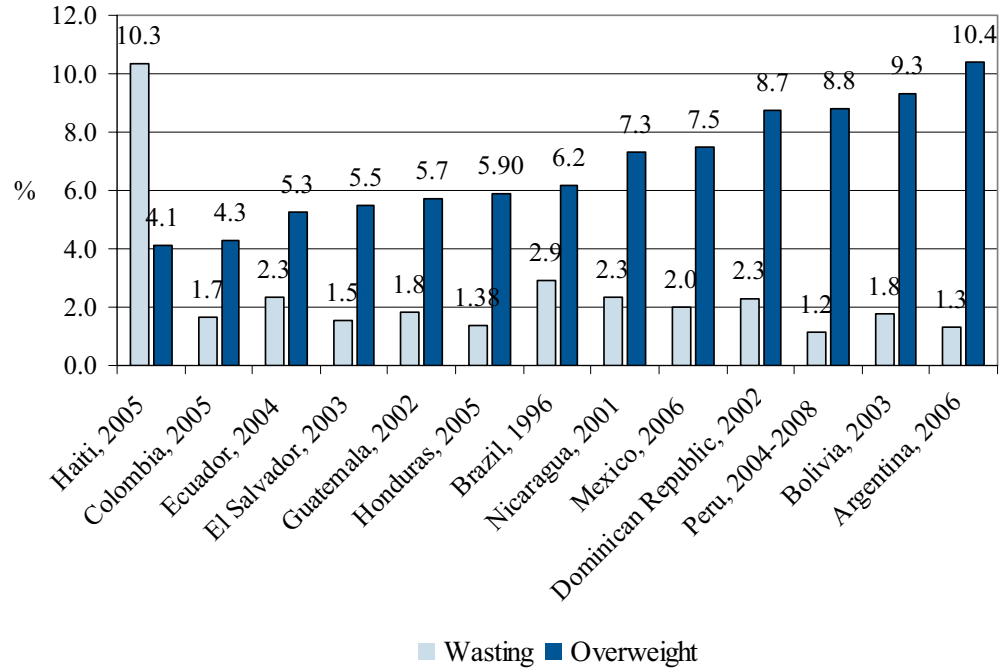
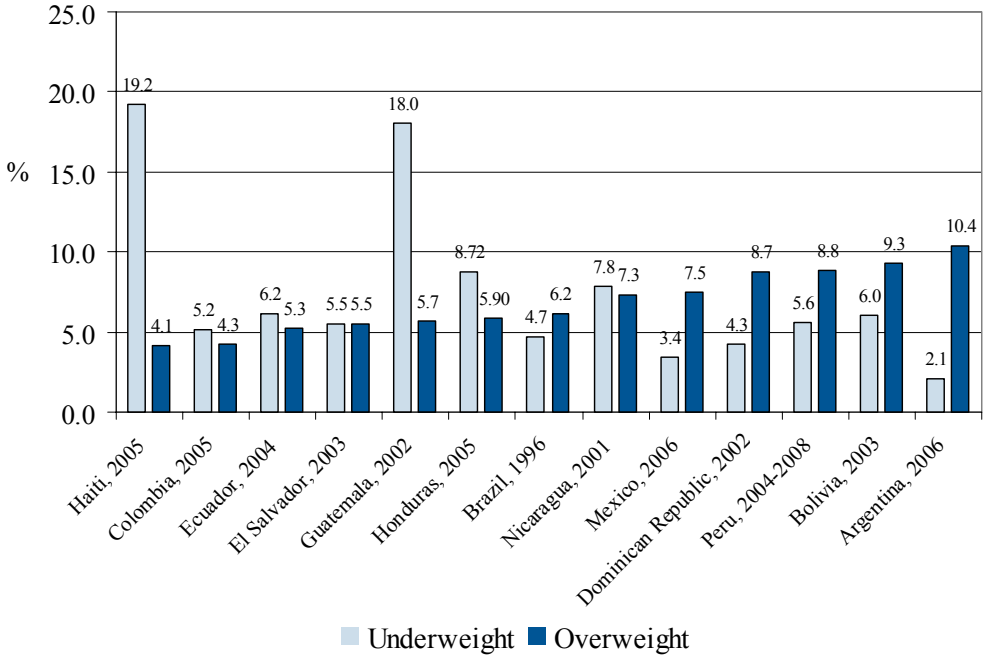


Figure 8. Prevalence of underweight vs. overweight by country, most recent survey only: WHO Child Growth Standard.



derweight and stunting (Figures 9-11). Faltering in both weight and length begins at birth and continues for approximately the first 24 months of life. However, whereas weight-for-age stabilizes thereafter at approximately -0.5 Z-scores, length/height-for-age stabilizes at -1.5 Z-scores. As a result, weight-for-length/height Z-scores are positive and stabilize at approximately 0.25 Z-scores, illustrating the right-shift in the distribution of weight-for-length/height.

The age-specific pattern of growth retardation in weight and length clearly show that the first 24 months of life and even more importantly, the first 6 months of life, represents a critical window of opportunity to intervene to prevent growth retardation that occurs after birth. Stunting is largely irreversible and after 24 months of life the deficits in linear growth that have accumulated are almost always permanent. However, deficits in weight are often recouped or exceeded, leading to short children who are overweight or obese.

3.5 Geographic variation in poor growth

Overall country prevalence estimates mask enormous within-country differences, which in percentage points are largest for stunting (Figures 12a-12d). In some countries, these within-country differences are also greater than between-country differences. As an example, in Peru, which showed some of the largest within-country variations in stunting, underweight and overweight; the overall mean prevalence of stunting was 29.8%, but ranged from a low of 6.7% in Tacna to a high of 60.1% in Huancavelica.

The large disparity in the prevalence of stunting within most countries indicates that improving mean Z-scores or national prevalence estimates may not be sufficient as further improvement in areas that are already doing well can mask the fact that in poor areas the situation is stagnant or getting worse. Therefore, in setting goals and monitoring trends it is

Figure 9. Mean weight-for-age Z-scores for all countries, most recent survey data: WHO Child Growth Standard. The heavy blue line represents the median for all countries.

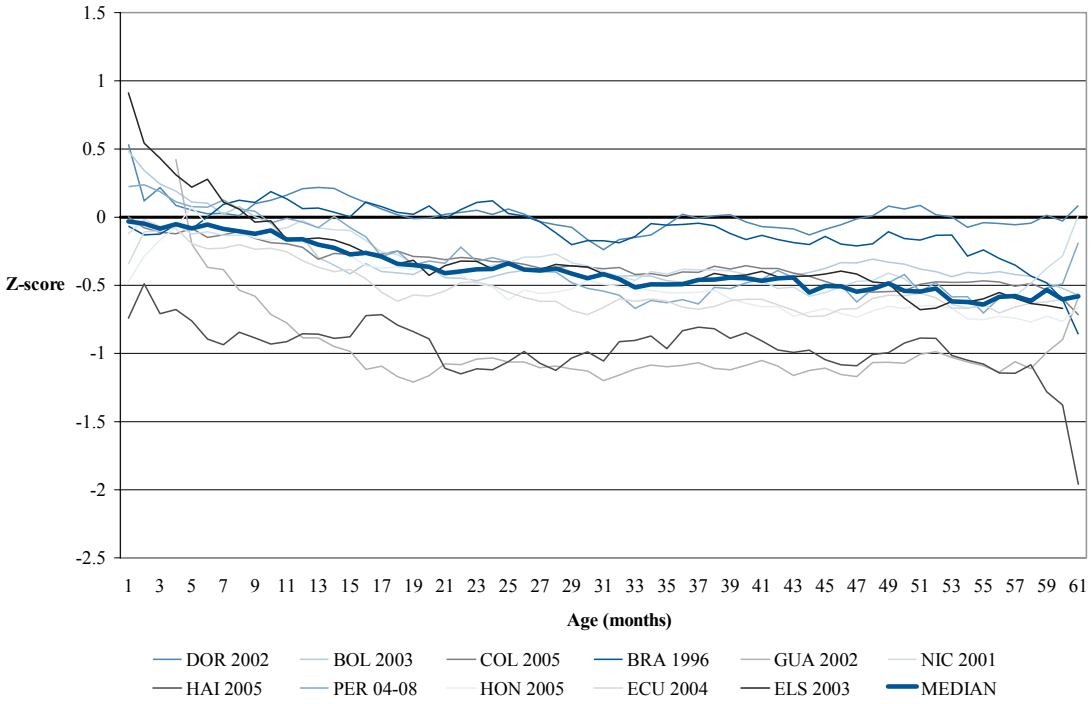


Figure 10. Mean length/height-for-age Z-scores for all countries, most recent survey data: WHO Child Growth Standard. The heavy blue line represents the median for all countries.

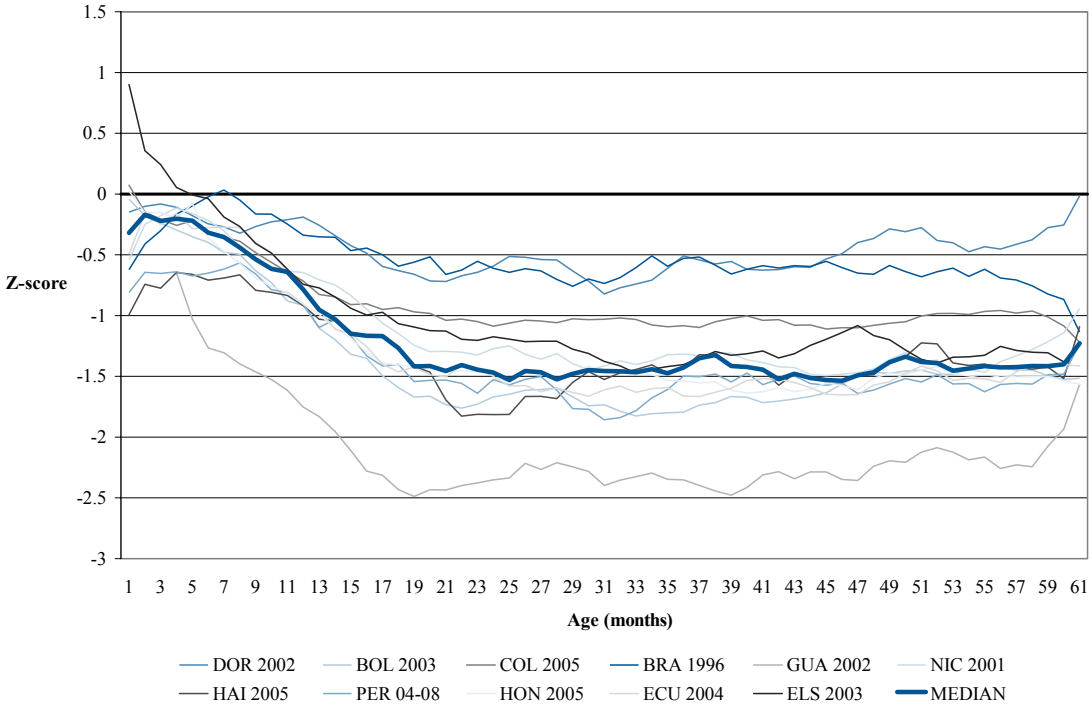
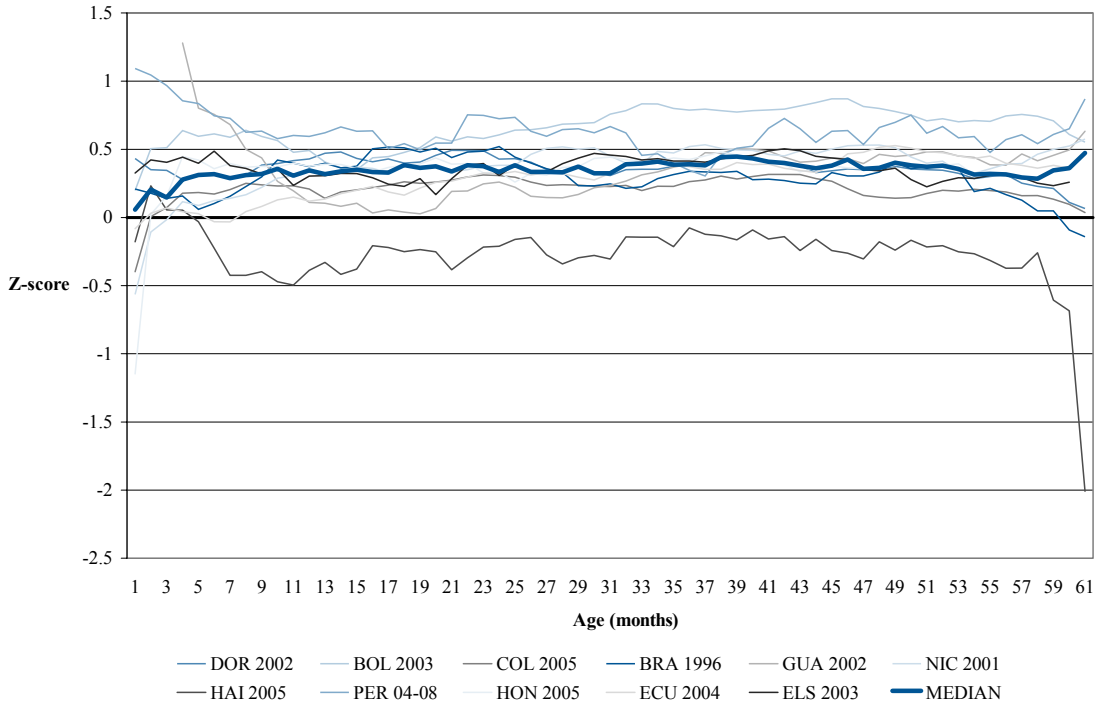


Figure 11. Mean weight-for-length/height Z-scores for all countries, most recent survey data: WHO Child Growth Standard. The heavy blue line represents the median for all countries.



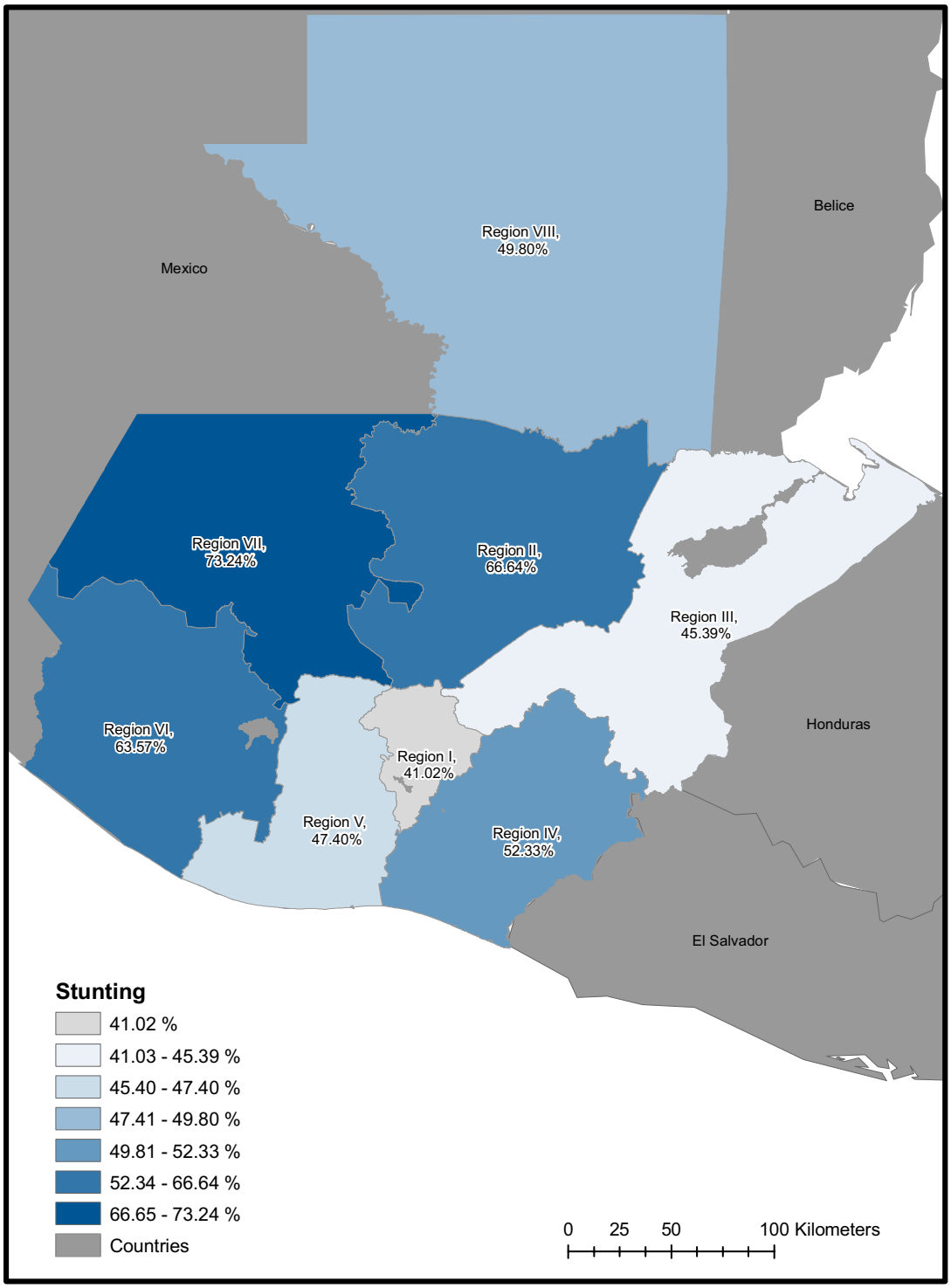
important that stunting in all areas is reduced below a target number. An example of within-country differences in stunting is illustrated in Map 1 for Guatemala. Individual country values for regional differences are also presented in the Appendix.

In general, within country differences in the prevalence of underweight follow a similar pattern to stunting; regions with the highest prevalence of stunting also have the highest prevalence of underweight. An example of within country differences for underweight is illustrated in Map 2 for Guatemala. In contrast, within country differences for wasting and overweight do not follow a predictable pattern.

3.6 Growth among indigenous children

Four countries (Bolivia, Ecuador, Guatemala and Peru) provided information on maternal ethnicity, thus allowing comparison of growth patterns among children of different ethnic backgrounds (Figures 13-16). Though ethnic identities differ between countries (e.g. Ecuador includes "black" as an ethnicity, which is not separated out in the remaining countries) a comparison of the indigenous groups versus the "white" or "ladino" groups shows the large nutrition disparities that exist. The disparity between indigenous vs. white/ladino children is most visible for stunting, where stunting is roughly twice as high in indigenous groups. For example, in Guatemala, nearly eight out

Map 1. Prevalence of stunting by region, Guatemala, 2002



Map2. Prevalence of underweight by region, Guatemala, 2002

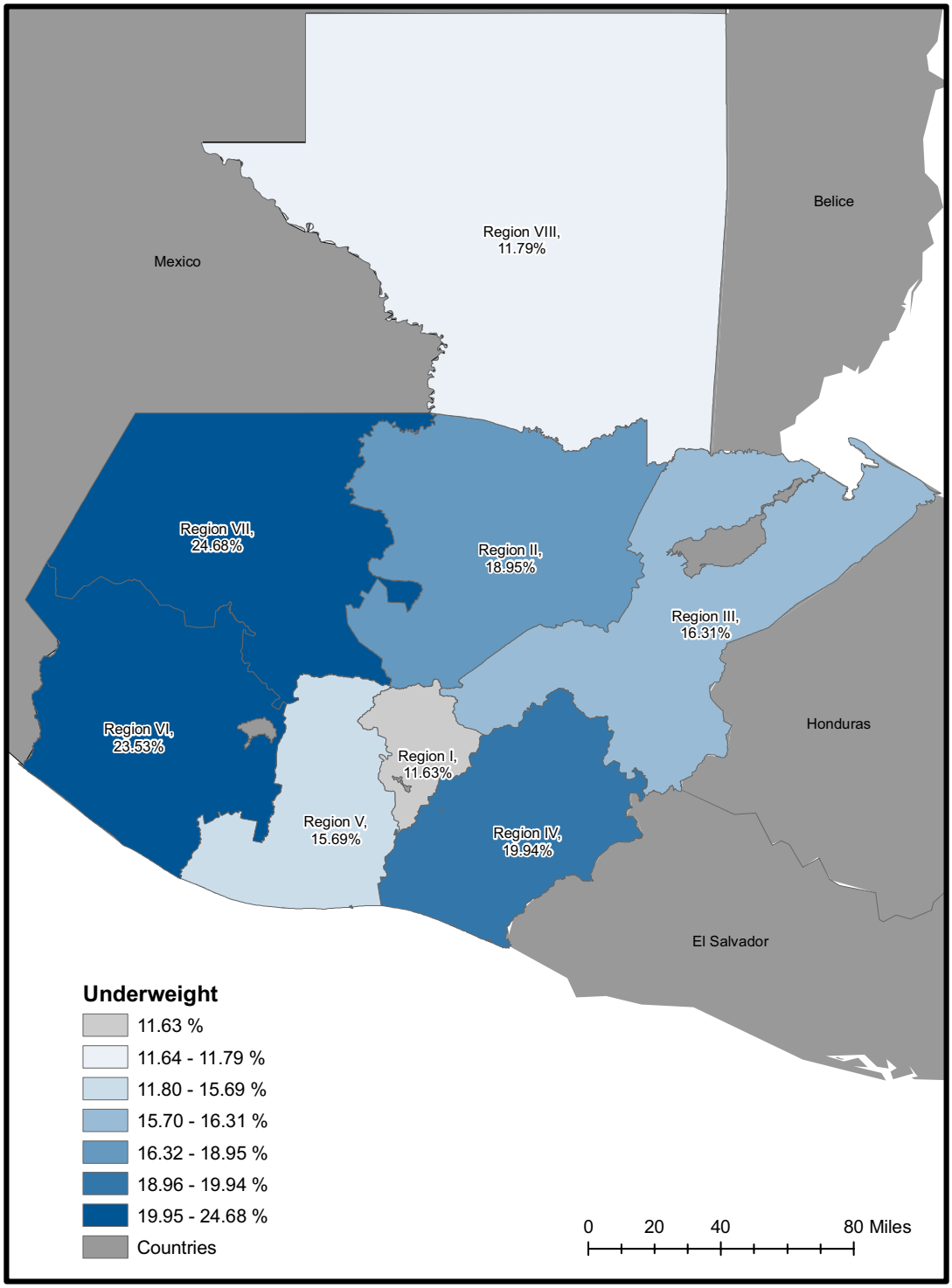
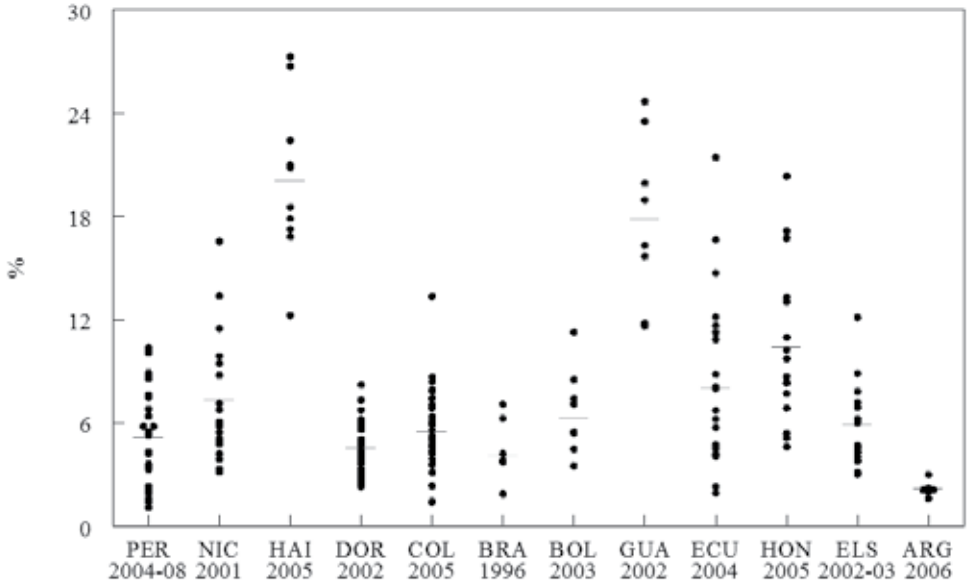
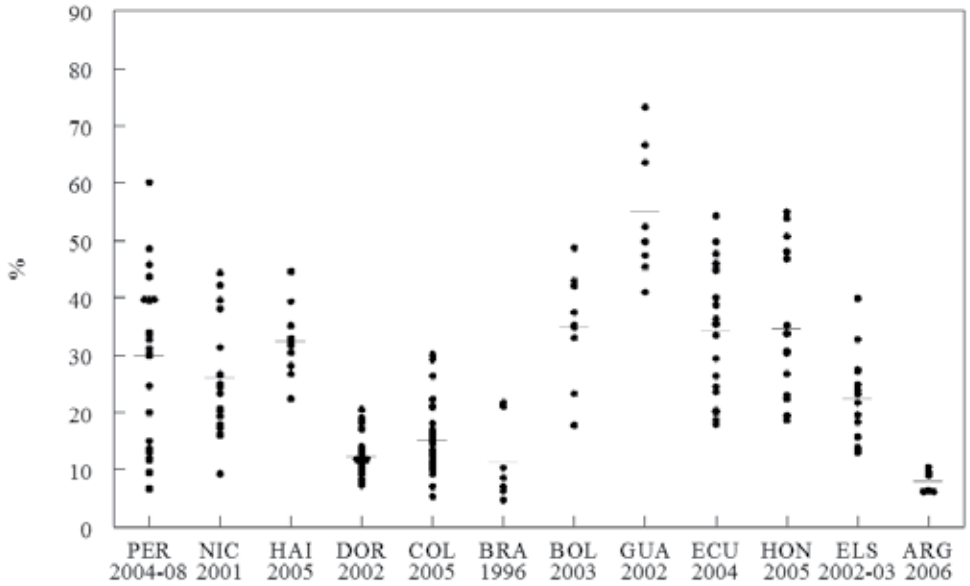


Figure 12a-d. Within country differences in the prevalence of underweight (a), stunting (b), wasting (c), overweight (d): WHO Child Growth Standards. Most recent DHS surveys only. Each point represents the prevalence in each region; the country mean prevalence is represented by the horizontal line. See Appendix for within-country data.

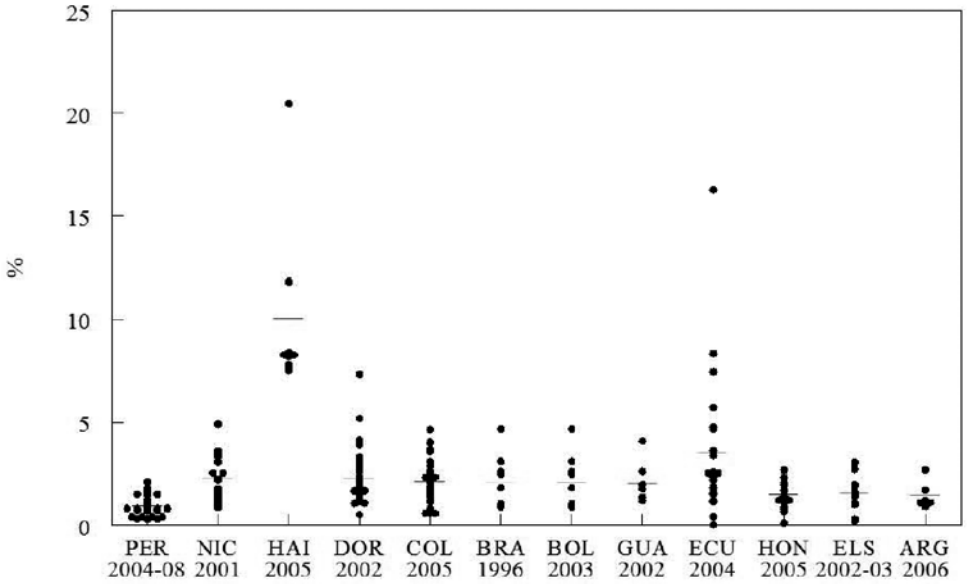
a. Underweight



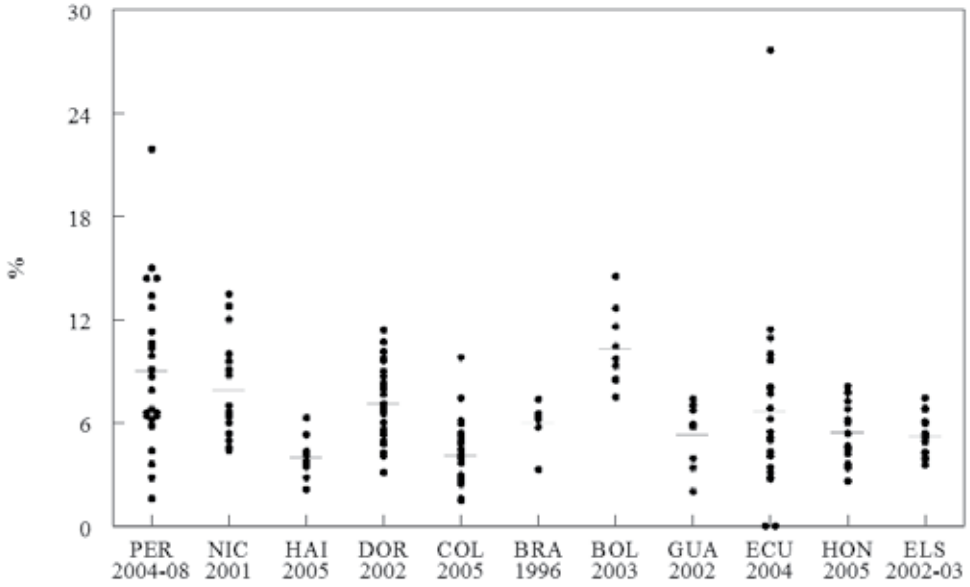
b. Stunting



c. Wasting



d. Overweight



of every 10 indigenous children are stunted, as opposed to four of every 10 ladino children (Figure 15). Peru's situation is similar, where over half of indigenous children under 5 are stunted, compared with a quarter of non-indigenous children (Figure 16). Underweight shows a similar pattern to stunting, with indigenous children having higher prevalences of underweight. The pattern of overweight, however, among indigenous vs. ladino/white children is not consistent from country to country. In Bolivia and Guatemala, the prevalence of overweight was slightly higher among indigenous children than among non-indigenous children. In Ecuador, the prevalence of overweight was roughly similar among different ethnic groups, whereas in Peru non-indigenous children had an overall higher prevalence of overweight than indigenous children.

3.7 Actual number of malnourished children

The current total number of stunted children, reflecting both the absolute number of children less than 5 years of age and the prevalence of stunting, ranged from130,397 in the Dominican Republic to 1,634,320 in Mexico and 2,194,774 in Brazil (though the most current data for Brazil is from 1996) (Table 3). Although Brazil had one of the lowest prevalences of stunting in 1996 (13.1%), it has the highest total number of stunted children because of its large population. Mexico's prevalence of stunting has decreased by roughly 10 percentage points in the last 20 years, but because of its large population under 5 years of age (of the countries analyzed, second only to Brazil), the total number of stunted children remains high.

Figure 13. Prevalence of underweight, stunting, wasting and overweight in Bolivia, 2003, among under-5 children by reported maternal ethnic group: WHO Child Growth Standard.

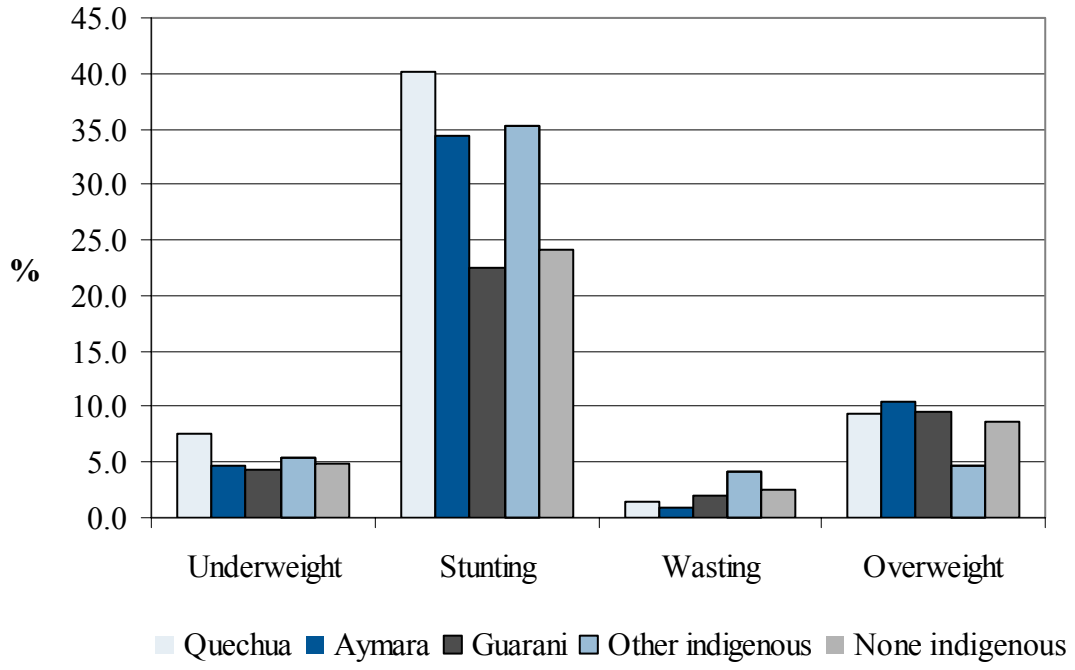


Figure 14. Prevalence of underweight, stunting, wasting and overweight in Ecuador, 2004, by reported maternal ethnic group: WHO Child Growth Standard.

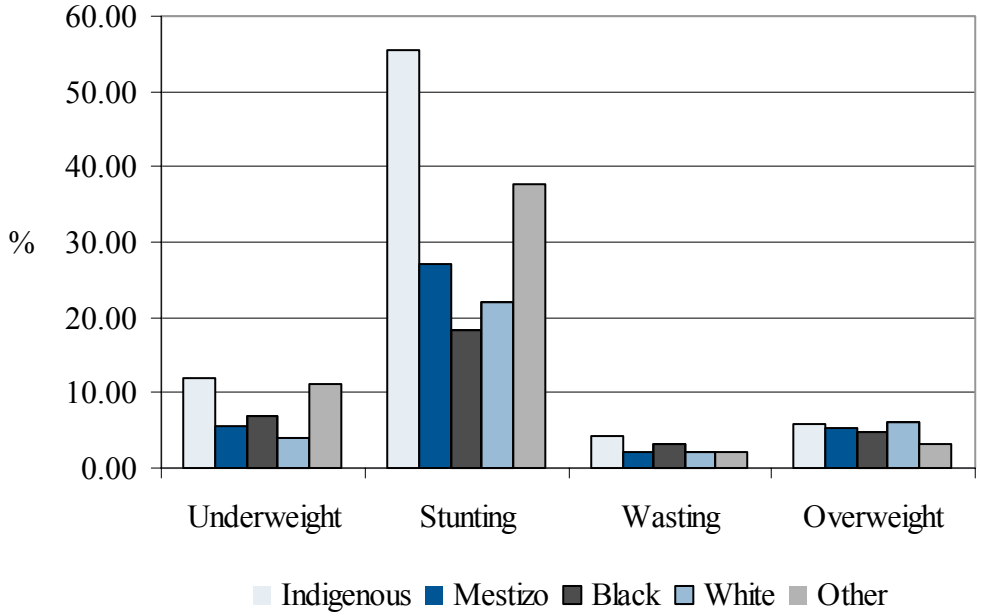


Figure 15. Prevalence of underweight, stunting, wasting and overweight in Guatemala, 2003, reported maternal ethnic group: WHO Child Growth Standard.

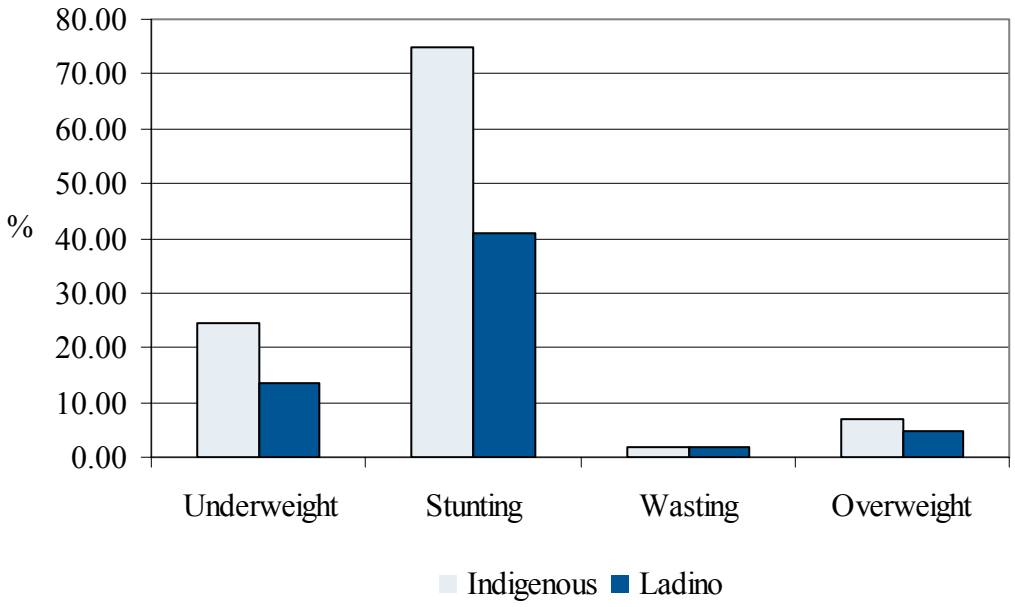
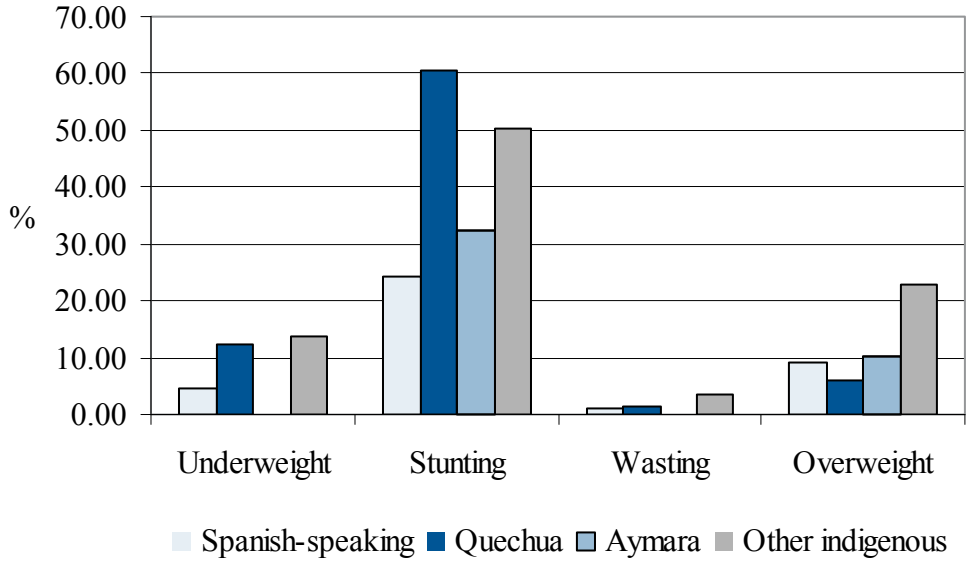


Figure 16. Prevalence of underweight, stunting, wasting and overweight in Peru, 2004-08, reported maternal ethnic group: WHO Child Growth Standard.



Guatemala also has more than one million stunted children, but due to its high prevalence of stunting, rather than a very large population of children under 5.

In almost all the countries, the actual number of stunted children declined because of declining prevalences of stunting and the fact that the size of the under-5 population was fairly constant over the survey years. Guatemala, however, experienced an increase in the total number of stunted children over survey years, partly due to the increase in the number of children under 5 years of age and a stagnating decline in the prevalence of stunting between 1998 and 2002.

The current total number of underweight children is far lower than stunted children because of the lower prevalences of underweight compared with stunting (Table 3). The number ranges from 42,657 children in El Salvador to 784,087 children in Brazil (1996 data). Again, the large number of underweight children in Brazil is due to the large population size rather than a high prevalence of underweight. Other countries with currently more than one hundred thousand underweight children include Haiti, Guatemala, Honduras, Colombia, Mexico and Peru. All countries experienced a decrease in the total number of underweight children across survey years.

Indicating the increasing problem of overweight in the Region, the estimated total number of overweight children exceeds the total number of underweight children in roughly half of the countries analyzed (Argentina, Bolivia, Brazil, Dominican Republic, Ecuador, El Salvador, Mexico and Peru). Brazil, again because of its large population, has over 1 million overweight children, followed by the next populous country in the Region with available data, Mexico, with close to 800,000 overweight children. All countries experienced an increase in the total number of overweight children across survey years with the exception of Colombia, Haiti, Nicaragua and Peru.

Table 3. Estimated total number of underweight, stunted and overweight children by country and survey year: WHO Child Growth Standard.

Country	Survey year	Population < 5 years of age (thousands)[1,2]	Prevalence of underweight (%)	Total number underweight	Prevalence of stunting (%)	Total number stunted	Prevalence of wasting (%)	Total number wasted	Prevalence of overweight (%)	Total number overweight
Argentina	2006	3,340	2.10	70,140	8.00	267,200	1.30	43,420	10.40	347,360
Bolivia	1989	1,038	9.04	93,835	42.07	436,687	2.20	22,836	8.11	84,182
	1994	1,157	12.57	145,435	34.55	399,744	5.54	64,098	8.21	94,990
	1998	1,190	6.02	71,638	33.48	398,412	1.65	19,635	11.00	130,900
	2003	1,239	6.02	74,588	32.63	404,286	1.75	21,683	9.30	115,227
Brazil	1986	18,511	10.00	1,851,100	34.07	6,306,698	2.05	379,476	5.03	931,103
	1996	16,754	4.68	784,087	13.10	2,194,774	2.90	485,866	6.16	1,032,046
Colombia	1985	4,244	8.64	366,682	26.09	1,107,260	1.28	54,323	4.98	211,351
	1995	4,628	6.49	300,357	19.88	920,046	1.70	78,676	4.55	210,574
	2000	4,591	4.96	227,714	18.33	841,530	1.04	47,746	5.57	255,719
	2005	4,481	5.15	230,772	16.26	728,611	1.65	73,937	4.26	190,891
Dominican Republic	1986	930	9.22	85,746	22.35	207,855	2.40	22,320	4.04	37,572
	1991	967	8.53	82,485	21.33	206,261	2.41	23,305	4.27	41,291
	1996	1,026	4.77	48,940	13.70	140,562	2.09	21,443	6.82	69,973
	2002	1,106	4.28	47,337	11.79	130,397	2.27	25,106	8.72	96,443
Ecuador	2004	1,425	6.17	87,866	29.31	417,608	2.34	33,314	5.27	75,153
El Salvador	1993	754	6.97	52,554	26.24	197,850	1.50	11,310	3.86	29,104
	1998	785	8.65	67,903	29.47	231,340	1.59	12,482	4.21	33,049
	2002/03	777	5.49	42,657	20.76	161,305	1.53	11,888	5.50	42,735
Guatemala	1987	1,414	27.87	394,082	62.39	882,195	2.54	35,916	2.81	39,733
	1995	1,707	22.00	375,540	55.53	947,897	3.92	66,914	6.32	107,882
	1998/99	1,863	20.47	381,356	53.39	994,656	2.94	54,772	7.08	131,900
	2002	2,036	18.02	366,887	54.47	1,109,009	1.85	37,666	5.71	116,256
Haiti	1994/95	1,191	24.22	288,460	37.49	446,506	9.31	110,882	4.38	52,166
	2000	1,229	14.06	172,797	28.91	355,304	5.57	68,455	3.31	40,680
	2005	1,239	19.21	238,012	30.13	373,311	10.34	128,113	4.14	51,295
Honduras	2001	938	12.58	118,000	34.55	324,079	1.26	11,819	3.14	29,453
	2005	940	8.72	81,968	30.15	283,410	1.38	12,972	5.90	55,460
Mexico	1988	11,097	10.80	1,198,476	26.90	2,985,093	6.20	688,014	6.10	676,917
	1999	10,985	5.60	615,160	21.50	2,361,775	2.10	230,685	7.50	823,875
	2006	10,544	3.40	358,496	15.50	1,634,320	2.00	210,880	7.50	790,800
Nicaragua	1997/98	738	10.41	76,826	30.72	226,714	3.39	25,018	7.03	51,881
	2001	708	7.83	55,436	25.37	179,620	2.33	16,496	7.29	51,613
Peru	1992	2,968	8.91	264,449	37.76	1,120,717	1.94	57,579	9.49	281,663
	1996	3,119	5.78	180,278	31.90	994,961	1.63	50,840	10.07	314,083
	2000	2,979	5.24	156,100	31.63	942,258	1.14	33,961	12.14	361,651
	2004/08	2,822	5.62	158,596	29.83	841,803	1.16	32,735	8.80	248,336

1 Source: World Population Prospects: The 2006 revision. United Nations Population Division, http://esa.un.org/unpp/index.asp?panel=2

2 The World Population Prospects provides population estimates in 5 year intervals (i.e. 1980, 1985 etc.). For surveys that were conducted in years for which no estimate was available, the population estimate for the year closest to the survey year was used.

4. Trends in malnutrition

The overall prevalence of underweight and stunting has decreased during the past two decades though the prevalence of stunting remains high. In addition, the most recent surveys of a few countries have shown that the already slow pace of decline has further slowed or reversed course. However, the annual rate of decline for stunting is on average higher than that of underweight for the survey years analyzed. The prevalence of wasting has generally declined and all countries, except Haiti, have prevalence estimates below what would be expected in a normally-distributed population (2.14%). The prevalence of overweight increased on average over the time period studied. In this section, we describe in detail these changes, examine trends from an equity perspective and provide estimates on achieving MDG 1 by 2015.

4.1 Trends in stunting

Although the general tendency in all countries has been a gradual decrease in stunting, in the most recent pairs of surveys, this trend has reversed or stagnated in a few countries (Tables 4, 5; Figure 17). Some countries, such as Bolivia, Colombia, Guatemala have experienced a slowing in the decline of stunting; for example, in Bolivia, between 1989-1994, the average annual decline was approximately 1.5 percentage points, whereas in more recent years (1998-2003), stunting only decreased by about 0.2 percentage points per year. The prevalence of stunting actually increased slightly from 29% to 30% in Haiti. In contrast, Mexico increased its rate of decline from half a percentage point per year between 1988 and 1999, to 0.85 percentage points between 1999 and 2006. Nicaragua showed the largest decline over the shortest period, from a prevalence of 30.7 to 25.4% between 1998 and 2001. Overall, the average annual decline between the earliest and latest surveys (1986-2006) for all countries combined was 0.7 percentage points per year, ranging from 2.1 percentage points in Brazil to 0.5 percentage points in Colombia, El Salvador and Guatemala (Table 5).

4.2 Trends in wasting

In many countries in the region, the prevalence of wasting did not change greatly, remaining between approximately 1 and 4% during the roughly two decades covered (Tables 4, 5; Figure 18). Haiti is the notable exception to this pattern, both in its much higher prevalence of wasting and also in the increase in wasting prevalence observed between 2000 (6%) and 2005 (10%). Other countries experiencing slight increases in the prevalence of wasting in the most recent surveys were Bolivia, Colombia, Honduras and the Dominican Republic. Peru showed no decline in the prevalence of wasting in the most recent time period. Overall, the average annual rate of decline in wasting between 1986 and 2005 (for all countries combined) was 0.01 percentage points per year.

Table 4. Trends in prevalence of underweight, stunting, wasting and overweight by country and survey year: WHO Child Growth Standard.

Country	Year	Prevalence of underweight (%)	Prevalence of stunting (%)	Prevalence of wasting (%)	Prevalence of overweight (%)
Bolivia	1989	9.04	42.07	2.20	8.11
	1994	12.57	34.55	5.54	8.21
	1998	6.02	33.48	1.65	11.00
	2003	6.02	32.63	1.75	9.30
Brazil	1986	10.00	34.07	2.05	5.03
	1996	4.68	13.10	2.90	6.16
Colombia	1986	8.64	26.09	1.28	4.98
	1995	6.49	19.88	1.70	4.55
	2000	4.96	18.33	1.04	5.57
	2005	5.15	16.26	1.65	4.26
Dominican Republic	1986	9.22	22.35	2.40	4.04
	1991	8.53	21.33	2.41	4.27
	1996	4.77	13.70	2.09	6.82
	2002	4.28	11.79	2.27	8.72
El Salvador	1993	6.97	26.24	1.50	3.86
	1998	8.65	29.47	1.59	4.21
	2003	5.49	20.76	1.53	5.50
Guatemala	1987	27.87	62.39	2.54	2.81
	1995	22.00	55.53	3.92	6.32
	1999	20.47	53.39	2.94	7.08
	2002	18.02	54.47	1.85	5.71
Haiti	1995	24.22	37.49	9.31	4.38
	2000	14.06	28.91	5.57	3.31
	2005	19.21	30.13	10.34	4.14
Honduras	2001	12.58	34.55	1.26	3.14
	2005	8.72	30.15	1.38	5.90
Mexico	1988	10.8	26.9	6.2	6.1
	1999	5.6	21.5	2.1	7.5
	2006	3.4	15.5	2	7.5
Nicaragua	1998	10.41	30.72	3.39	7.03
	2001	7.83	25.37	2.33	7.29
Peru	1992	8.91	37.76	1.94	9.49
	1996	5.78	31.90	1.63	10.07
	2000	5.24	31.63	1.14	12.14
	2004/08	5.62	29.83	1.16	8.80

Table 5. Annual percentage point change in the prevalence of under nutrition

Country	Percentage point change in prevalence per year			
	Underweight	Stunting	Wasting	Overweight
Bolivia				
1989-94	0.71	-1.50	0.67	0.03
1994-98	-1.64	-0.27	-0.97	0.70
1998-03	0.00	-0.17	0.02	-0.34
Overall	-0.22	-0.67	-0.03	0.08
Brazil				
1986-1996	-0.53	-2.10	0.09	0.11
Colombia				
1986-95	-0.24	-0.69	0.05	-0.05
1995-00	-0.31	-0.31	-0.13	0.20
2000-05	0.04	-0.41	0.12	-0.26
Overall	-0.18	-0.52	0.02	-0.04
Dominican Republic				
1986-91	-0.14	-0.20	0.00	0.04
1991-96	-0.75	-1.53	-0.06	0.51
1996-00	-0.08	-0.32	0.03	0.32
Overall	-0.31	-0.66	-0.01	0.29
El Salvador				
1993-98	0.34	0.65	0.02	0.07
1998-03	-0.63	-1.74	-0.01	0.26
Overall	-0.15	-0.55	0.00	0.16
Guatemala				
1987-95	-0.73	-0.86	0.17	0.44
1995-99	-0.38	-0.53	-0.25	0.19
1999-02	-0.82	0.36	-0.36	-0.46
Overall	-0.66	-0.53	-0.05	0.19
Haiti				
1995-00	-2.03	-1.72	-0.75	-0.21
2000-05	1.03	0.24	0.95	0.17
Overall	-0.50	-0.74	0.10	-0.02
Honduras				
2001-05	0.97	-1.10	0.03	0.69

Continue >

Continue **Table 5.** Annual percentage point change in the prevalence of under nutrition

Country	Percentage point change in prevalence per year			
	Underweight	Stunting	Wasting	Overweight
Mexico				
1988-1999	-0.47	-0.49	-0.37	0.13
1999-2006	-0.31	-0.86	-0.01	0.00
Overall	-0.41	-0.63	-0.23	0.08
Nicaragua				
1998-01	-0.86	-1.78	-0.35	0.09
Peru				
1992-96	-0.78	-1.47	-0.08	0.14
1996-00	-0.13	-0.07	-0.12	0.52
2004-08	0.08	-0.36	0.00	-0.67
Overall	-0.25	-0.61	-0.06	-0.05
Overall median annual change	-0.41	-0.66	-0.01	0.09

Figure 17. Trends in prevalence of stunting, by survey year and country: WHO Child Growth Standard.

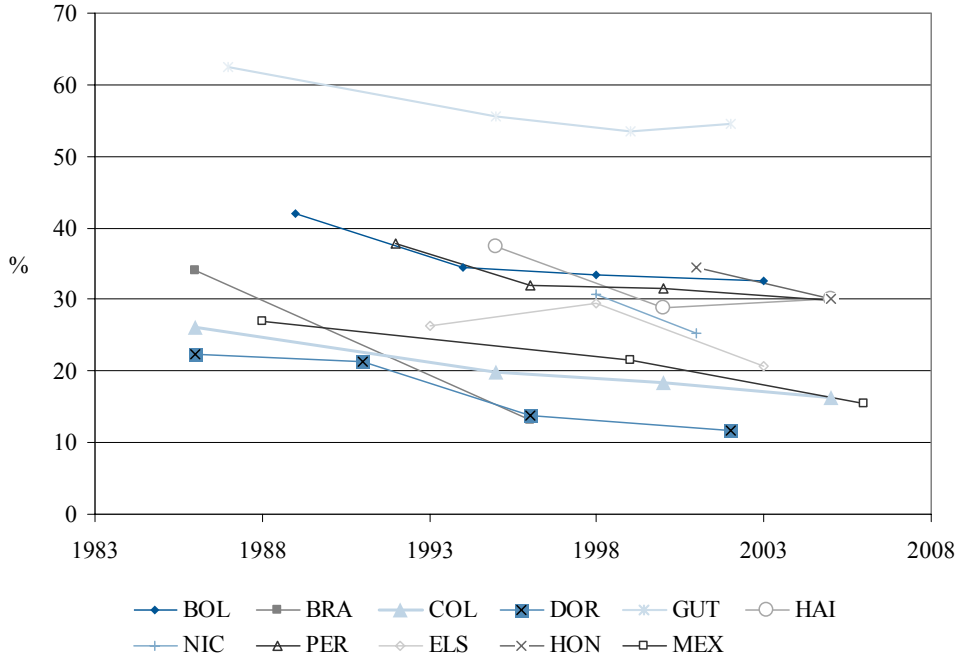
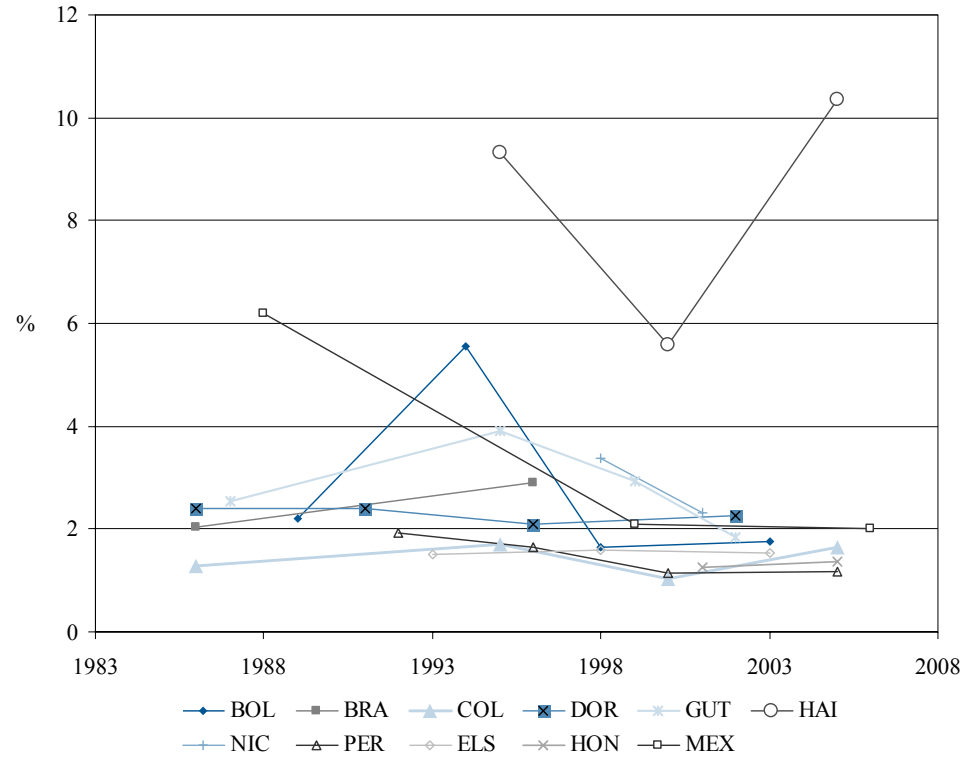


Figure 18. Trends in prevalence of wasting, by survey year and country: WHO Child Growth Standard.



4.3 Trends in underweight

Reductions for underweight were smaller than those for stunting; however, as noted above the prevalences were much lower to begin with (Tables 4, 5; Figure 19). Haiti and Peru both exhibited an increase in the prevalence of underweight between the last two survey years: the prevalence of underweight increased in Haiti from 14% in 2000 to 19% in 2005. In Peru, the prevalence of underweight increased roughly half a percentage point, from 5.2 in 2000 to 5.6% in 2004-08. Two other countries, Colombia and Bolivia, did not show further decreases in the prevalence of underweight after the late 1990s; the prevalence of underweight remained at 6% in Bolivia and 5% in Colombia between 2000-05 and 1998-2003, respectively.

The average annual percentage point decline in underweight between the earliest and latest survey ranged from 2.85 percentage points in Nicaragua to 0.2 percentage points in El Salvador and Colombia (Table 5). Overall, the average annual rate of decline in underweight between 1986 and 2006 (for all countries combined) was 0.4 percentage points per year, slightly more than half the rate of decline for stunting.

4.4 Trends in overweight

The trend in overweight prevalence is generally upward (Tables 4, 5; Figure 20). Bolivia, Brazil, the Dominican Republic, El Salvador, Guatemala, Honduras, Mexico and Nicaragua all experienced an overall upward trend across survey years. Colombia and Haiti were the only two countries to experience an overall decline in overweight prevalence, however the patterns were slightly different. In Colombia, an increase in overweight between 1995 and 2000 was counteracted by an approximately

Figure 19. Trends in prevalence of underweight, by survey year and country: WHO Child Growth Standard.

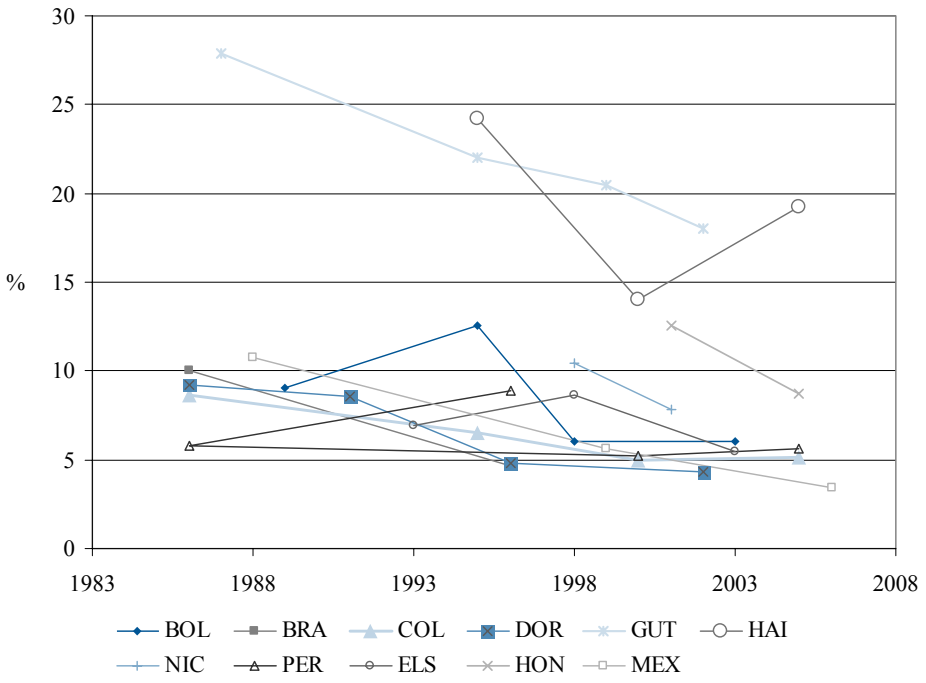
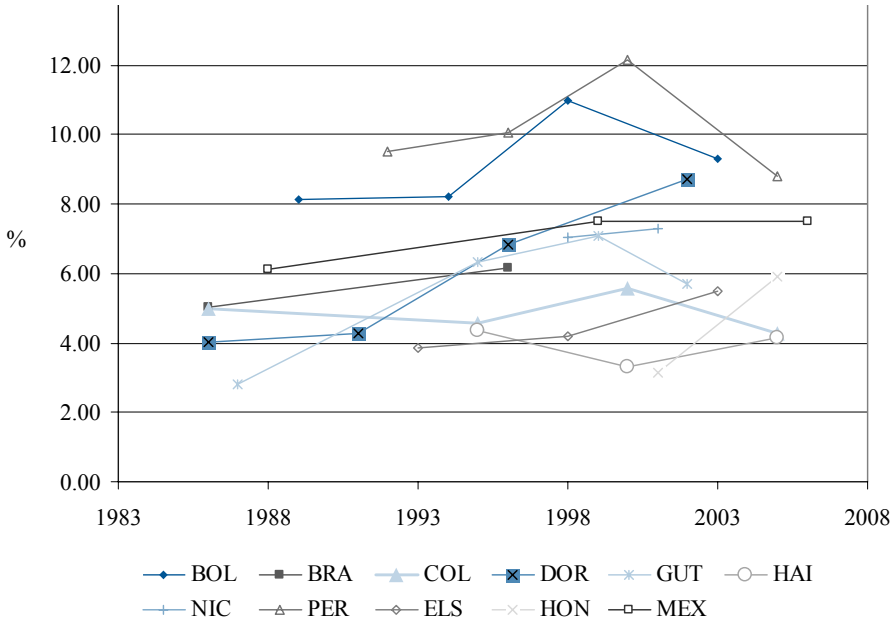


Figure 20. Trends in prevalence of overweight, by survey year and country: WHO Child Growth Standard.



equal decrease between 2000 and 2005, while in Haiti, the opposite pattern occurred (a decrease between 1995 and 2000 followed by an increase between 2000 and 2005) (Table 5). Peru, Bolivia and Guatemala, exhibited upward trends in overweight prevalence in the earlier surveys but those trends appear to have reversed between the last two surveys of each country, although overweight prevalence at the most recent survey remained roughly equal to or higher than the prevalence at the earliest survey in all three countries. Overall, the average annual rate of increase in overweight prevalence between 1986 and 2006 (for all countries combined) was 0.09 percentage points per year.

4.5 Trends and equity

Analysis of the prevalence of the anthropometric indicators by levels of maternal education (or by levels of socioeconomic status) showed that inequities in prevalence estimates over time did not change greatly (Tables 6-9; see Appendix for individual country graphs). For stunting and underweight (Tables 6 and 7), children of better educated mothers had a lower prevalence of these indicators in comparison to less-educated mothers as would be expected. This pattern was generally consistent across time periods and the declines within each subgroup were relatively parallel in most countries. However, some countries did challenge this trend: for example, in Brazil and the Dominican Republic, the largest decreases in stunting were found among children of the least-educated mothers. Similarly, in Bolivia, decreases in stunting between 1989 and 2003 were roughly eight percentage points across three levels of maternal education (none, primary and secondary). Also, in Mexico stunting has declined more in rural areas than urban areas indicating a lessening of inequities. [32] In contrast, in Guatemala, the decrease in stunting prevalence between 1987 and 2002 ranged from 2.2 percentage points among children of

Table 6. Trends in prevalence of stunting by highest levels of maternal education attended: none, primary, secondary or higher: WHO Child Growth Standard.

Country	Survey year	Stunting prevalence by highest level of maternal education attended			
		None	Primary	Secondary	Higher
Bolivia	1989	59.42	45.45	27.74	15.26
	1994	50.00	40.07	24.51	8.95
	1998	54.85	39.39	21.57	17.08
	2003	51.40	37.50	18.85	12.96
Brazil	1986	46.84	33.71	14.41	4.55
	1996	25.33	18.82	7.94	2.83
Colombia	1986	41.02	30.20	16.34	12.05
	1995	30.42	26.27	13.80	8.41
	2000	27.12	23.99	15.09	5.41
	2005	33.01	21.80	13.25	5.58
Dominican Republic	1986	37.03	26.95	10.81	3.20
	1991	36.86	25.78	15.41	3.26
	1996	28.95	16.72	7.13	1.91
	2002	19.38	14.80	8.92	4.52
El Salvador	1993	37.34	27.84	14.76	5.47
	1998	62.45	29.42	13.17	8.96
	2003	42.73	22.06	7.80	4.54
Guatemala	1987	72.91	57.03	29.61	13.64
	1995	69.23	53.17	19.83	11.12
	1999	71.50	51.75	20.11	1.64
	2002	70.71	52.07	24.06	8.37
Haiti	1995	44.18	34.34	19.68	0.00
	2000	34.57	25.98	17.34	7.14
	2005	39.30	30.47	14.41	1.53
Honduras	2001	56.04	37.31	10.54	3.83
	2005	54.08	33.39	9.90	4.33
Nicaragua	1998	45.03	34.30	16.44	8.18
	2001	42.43	28.24	12.98	5.41
Peru	1986	67.27	49.77	26.07	10.78
	1996	56.61	43.74	21.36	8.58
	2000	58.14	45.33	20.15	10.93
	2004-08	62.09	47.11	19.92	6.09

Table 7. Trends in prevalence of underweight by highest levels of maternal education attended: none, primary, secondary or higher: WHO Child Growth Standard.

Country	Survey year	Underweight prevalence (%) by highest level of maternal education attended			
		None	Primary	Secondary	Higher
Bolivia	1989	17.05	9.19	4.33	2.05
	1994	20.61	14.45	8.30	2.30
	1998	11.58	6.88	3.73	2.32
	2003	10.38	7.03	2.61	2.12
Brazil	1986	16.53	9.39	1.80	0.00
	1996	10.25	6.98	2.52	0.00
Colombia	1986	12.86	11.04	4.03	0.00
	1995	12.97	8.71	4.19	1.23
	2000	9.31	5.66	4.78	0.84
	2005	11.12	6.43	4.37	1.89
Dominican Republic	1986	14.77	10.86	5.10	1.74
	1991	15.61	10.83	4.00	3.36
	1996	12.40	5.51	2.53	0.53
	2002	6.12	5.62	2.56	1.70
El Salvador	1993	10.08	7.26	4.06	0.78
	1998	31.47	8.81	2.44	2.32
	2003	6.71	6.24	1.24	1.09
Guatemala	1987	35.86	22.71	7.84	0.00
	1995	29.32	19.75	7.26	4.98
	1999	28.86	19.37	6.01	0.00
	2002	24.65	16.55	6.67	4.45
Haiti	1995	29.02	21.70	12.09	0.00
	2000	17.06	12.39	8.74	1.83
	2005	23.43	19.80	12.21	2.23
Honduras	2001	22.93	13.26	2.95	1.64
	2005	17.70	9.29	2.62	2.65
Nicaragua	1998	14.83	12.01	5.24	2.26
	2001	14.43	7.85	4.13	1.52
Peru	1986	19.29	11.95	4.91	2.75
	1996	12.00	8.38	2.74	1.62
	2000	12.88	8.00	2.42	1.06
	2004-08	16.70	9.43	2.85	0.59

Table 8. Trends in prevalence of wasting by highest levels of maternal education attended: none, primary, secondary or higher: WHO Child Growth Standard.

Country	Survey year	Wasting prevalence (%) by highest level of maternal education attended			
		None	Primary	Secondary	Higher
Bolivia	1989	4.59	1.58	1.93	1.23
	1994	9.81	5.83	3.84	3.27
	1998	1.99	1.78	1.49	1.03
	2003	1.27	2.09	1.25	1.40
Brazil	1986	2.55	2.25	0.00	0.00
	1996	6.01	3.25	2.32	1.75
Colombia	1986	3.59	1.12	1.12	0.00
	1995	2.75	2.05	1.43	0.27
	2000	2.17	1.06	0.90	1.27
	2005	2.34	1.50	1.87	1.34
Dominican Republic	1986	1.58	2.92	1.78	0.00
	1991	2.30	2.61	1.97	2.65
	1996	3.40	2.23	2.12	0.58
	2002	3.15	2.65	1.81	0.90
El Salvador	1993	1.87	1.32	1.57	0.78
	1998	3.38	1.52	0.64	1.21
	2003	1.82	1.46	1.20	1.08
Guatemala	1987	2.93	2.34	1.32	0.00
	1995	4.44	3.94	1.64	10.27
	1999	3.56	3.19	0.74	0.05
	2002	2.34	1.62	1.52	0.00
Haiti	1995	9.92	9.09	7.23	6.44
	2000	5.74	5.33	7.20	9.79
	2005	11.40	10.13	10.41	4.96
Honduras	2001	2.39	1.25	0.44	0.55
	2005	2.24	1.45	0.95	0.79
Nicaragua	1998	3.99	3.72	2.43	2.76
	2001	4.10	2.10	1.34	2.69
Peru	1986	1.54	2.43	1.81	1.25
	1996	3.23	1.80	1.14	1.26
	2000	2.63	1.39	0.80	0.59
	2004-08	0.00	1.62	1.11	0.57

Table 9. Trends in prevalence of overweight by highest levels of maternal education attended: none, primary, secondary or higher: WHO Child Growth Standard.

Country	Survey year	Overweight prevalence (%) by highest level of maternal education attended			
		None	Primary	Secondary	Higher
Bolivia	1989	8.65	8.42	7.26	7.40
	1994	9.27	8.09	8.01	8.15
	1998	12.70	10.89	9.85	13.78
	2003	9.93	9.33	8.36	12.36
Brazil	1986	3.83	4.38	11.82	4.55
	1996	4.58	5.20	7.20	5.45
Colombia	1986	3.60	4.92	5.53	2.80
	1995	4.53	4.38	4.67	6.03
	2000	3.52	5.46	5.75	5.93
	2005	1.80	2.87	4.76	6.74
Dominican Republic	1986	3.37	3.46	5.49	5.53
	1991	4.18	3.57	5.09	5.77
	1996	2.84	5.86	7.47	12.95
	2002	4.22	6.74	10.59	12.55
El Salvador	1993	2.90	3.61	5.17	4.69
	1998	7.71	3.76	6.83	8.79
	2003	5.62	5.71	7.30	5.64
Guatemala	1987	3.02	2.75	1.32	4.55
	1995	6.67	6.21	5.40	7.92
	1999	8.12	6.02	9.14	1.05
	2002	5.55	4.59	9.37	15.81
Haiti	1995	4.74	3.99	3.57	12.88
	2000	2.48	2.66	3.86	5.32
	2005	3.98	4.47	3.73	10.39
Honduras	2001	2.08	2.83	4.63	7.10
	2005	3.01	4.80	11.06	7.50
Nicaragua	1998	6.69	6.70	7.44	10.31
	2001	7.63	6.63	7.18	11.30
Peru	1986	9.50	9.05	9.26	11.03
	1996	8.54	8.63	10.95	13.00
	2000	9.63	10.91	13.30	13.77
	2004-08	3.73	6.65	10.12	11.84

mothers with no education, to 5.5 percentage points among children of mothers with secondary education, showing a continuing trend in inequity. In recent years in a few countries, inequities are actually increasing. For example, in Peru, between the 2000 and 2004-2008 survey, underweight increased nearly 4 percentage points among women with no education, whereas among women with secondary or higher levels of education, underweight stayed relatively the same, or decreased slightly. In Colombia between 2000 and 2005, there was an overall decrease in stunting prevalence, but when viewed by maternal education level, the prevalence decreased among children of women with primary and secondary education (by approximately 2 percentage points), stayed relatively the same among children of higher educated mothers and increased by approximately 6 percentage points among women with no education.

With regards to overweight, in many countries, children of women with more education had a greater upward trend over time than children of less-educated mothers. This is to be expected given that maternal education is well correlated with income, which in less-developed countries undergoing the epidemiological, demographic and nutrition transitions, is associated with higher levels of overweight and obesity.[33] Several countries with data after 2000 show a decrease in levels of overweight, however, which is most apparent in the less-well-educated mothers. For example, in Colombia, between 2000 and 2005, overweight prevalence among children decreased in the three lower categories of maternal education, but continued increasing in the highest category of education. In contrast however, in the Dominican Republic, between 1996 and 2002, the prevalence of overweight increased in the three lower categories of education, but remained relatively flat among children of mothers in the highest category of education.

The regional wealth index analyses (Figures 21-28) did not show consistent patterns

Figure 21. Bolivia 1986-2003 change in prevalence of stunting by Wealth Index and region

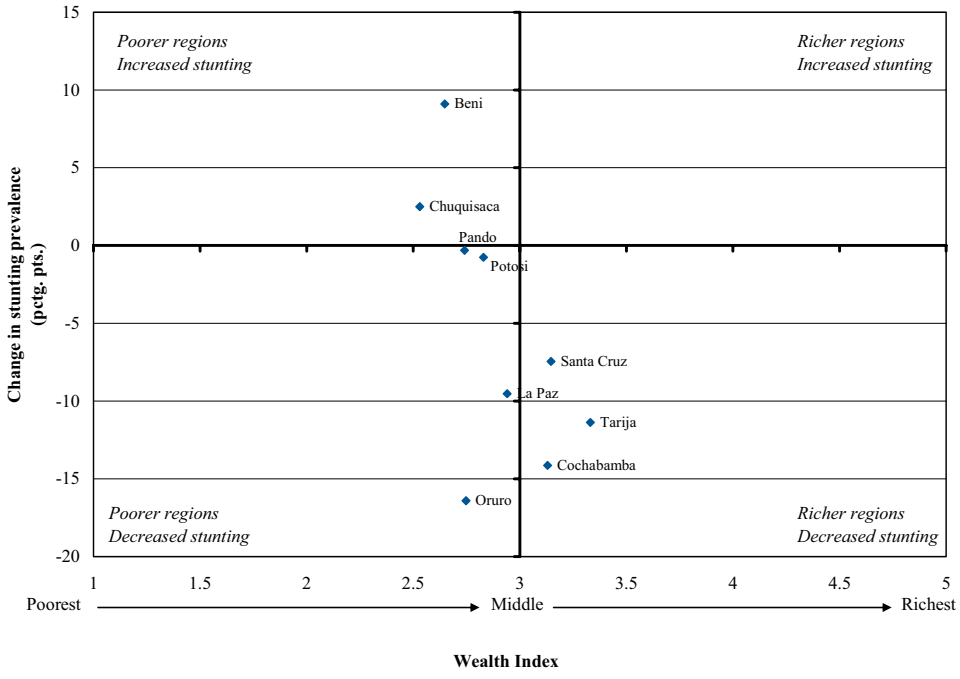
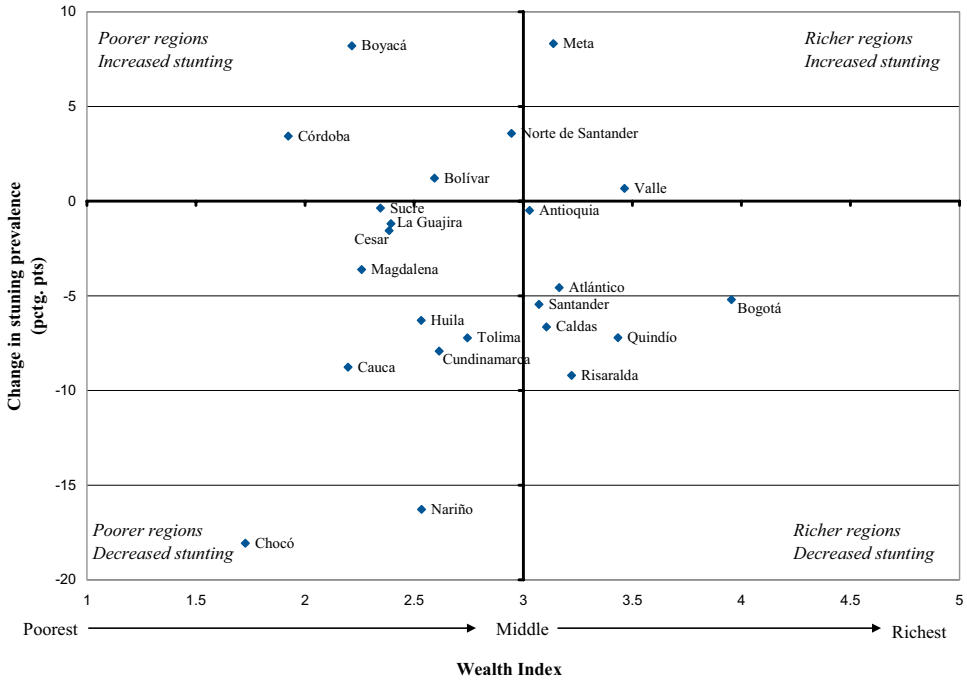


Figure 22. Colombia 1995-2005 change in prevalence of stunting by Wealth Index and region



of changes in stunting prevalence by a region's wealth. In some countries, wealthier regions were more successful at reducing stunting than less well-off regions, while in other countries, the opposite was true. For example, in the Dominican Republic (Figure 23), large reductions in stunting were seen between 1996 and 2002 in several of the poorest regions: Elias Piñas, Monte Plata and Dajabon. In contrast, the two richest regions of the same country (Distrito Nacional and Santiago) actually showed increases in stunting prevalence during the same period. Peru, however, showed a somewhat opposite pattern to that of the Dominican Republic. In Peru, (Figure 28) many of the poorest regions, for example, Puno and Huanuco, showed large increases in stunting prevalence between 1996 and 2004-08. However, there were poor regions throughout Peru that saw decreases in stunting (for example Loreto and Ayacucho), at the same time, richer regions such as Arequipa and Moquegua, had increases in stunting prevalence. Bolivia (Figure 21) follows a similar pattern to Peru, but Guatemala and Nicaragua (Figures 25 and 27, respectively) appear to exhibit much more equitable patterns in the reduction of stunting prevalence. Almost all regions in these two countries, regardless of their mean wealth index, reduced their prevalence of stunting during the time period studied. In Colombia (Figure 22) there does not appear to be a relationship between reduction of stunting and regional wealth, with poor and rich regions being equally successfully at reducing stunting. Of particular note are Chocó and Nariño, which are two poorer regions of the country which showed large decreases in the prevalence of stunting during the 10 years between 1995 and 2005. In El Salvador (Figure 24) stunting decreased in almost all regions. The reasons for each country's more- or less-equitable pattern in reductions in stunting prevalence will be important for determining why it is that some poor regions succeed at addressing child malnutrition, where richer regions may still struggle to improve or actually experience stagnation or reversal in stunting levels.

Figure 23. Dominican Republic 1996-2002 change in prevalence of stunting by Wealth Index and region

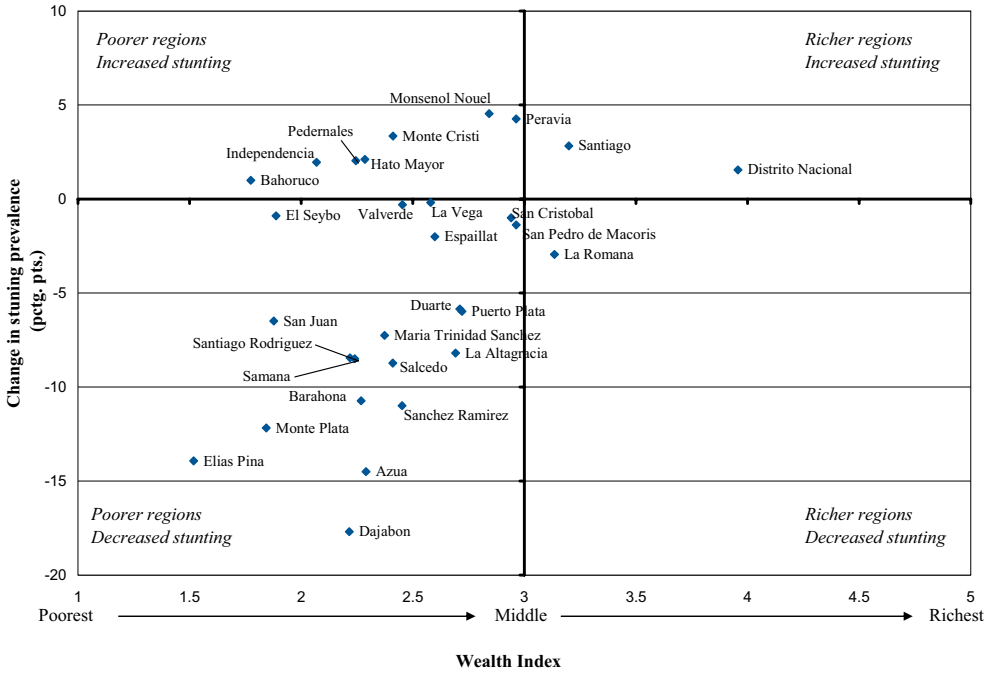


Figure 24. El Salvador 1993-2003 change in prevalence of stunting by SES Index and region

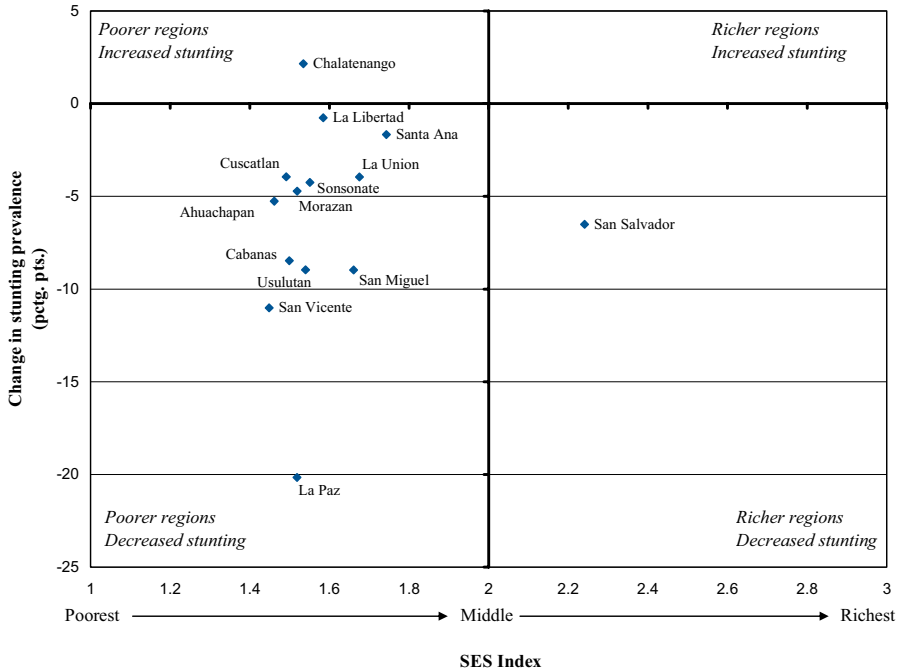


Figure 25. Guatemala 1987-2002 change in prevalence of stunting by SES Index and region

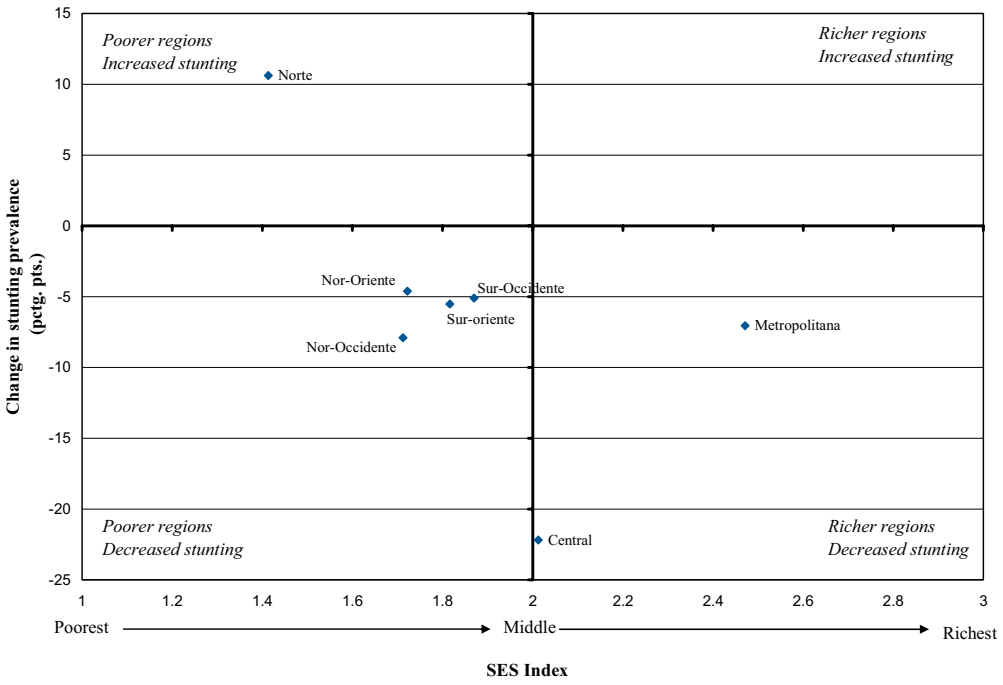


Figure 26. Haiti 2000-2005 change in prevalence of stunting by Wealth Index and region

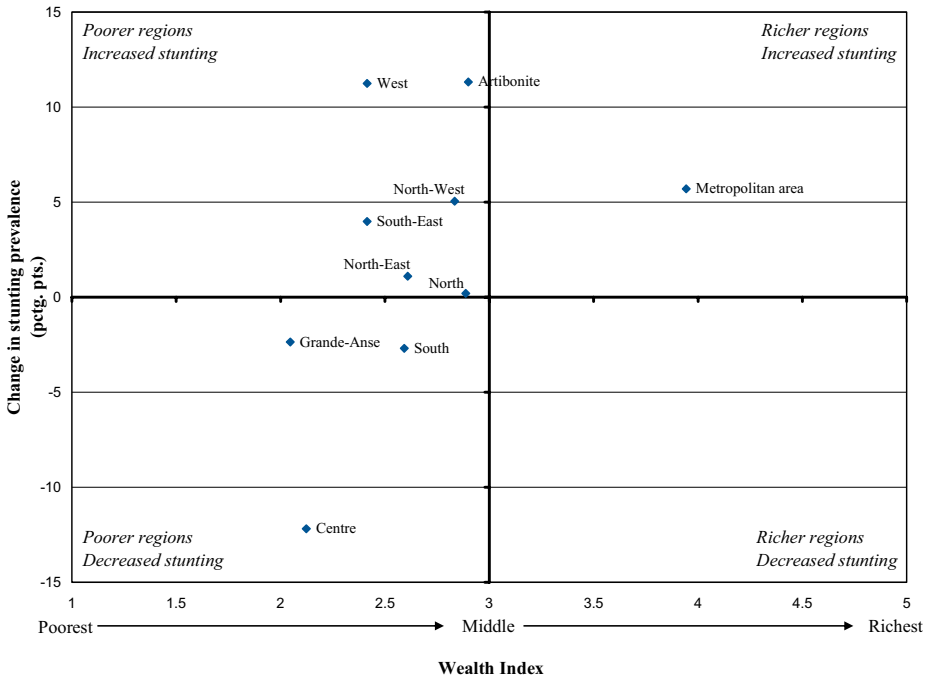


Figure 27. Nicaragua 1998-2001 change in prevalence of stunting by Wealth Index and region

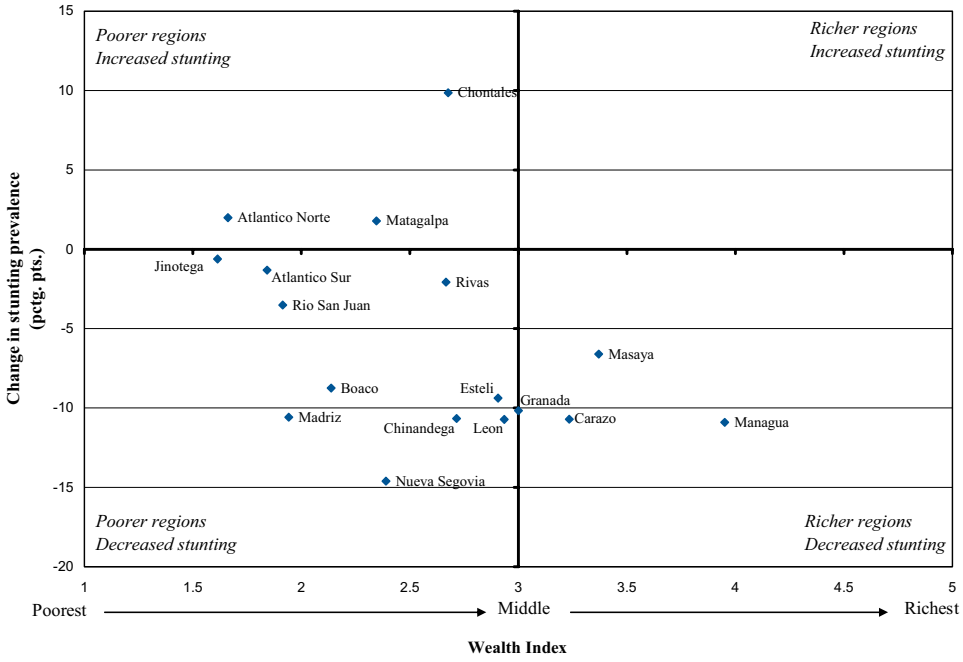
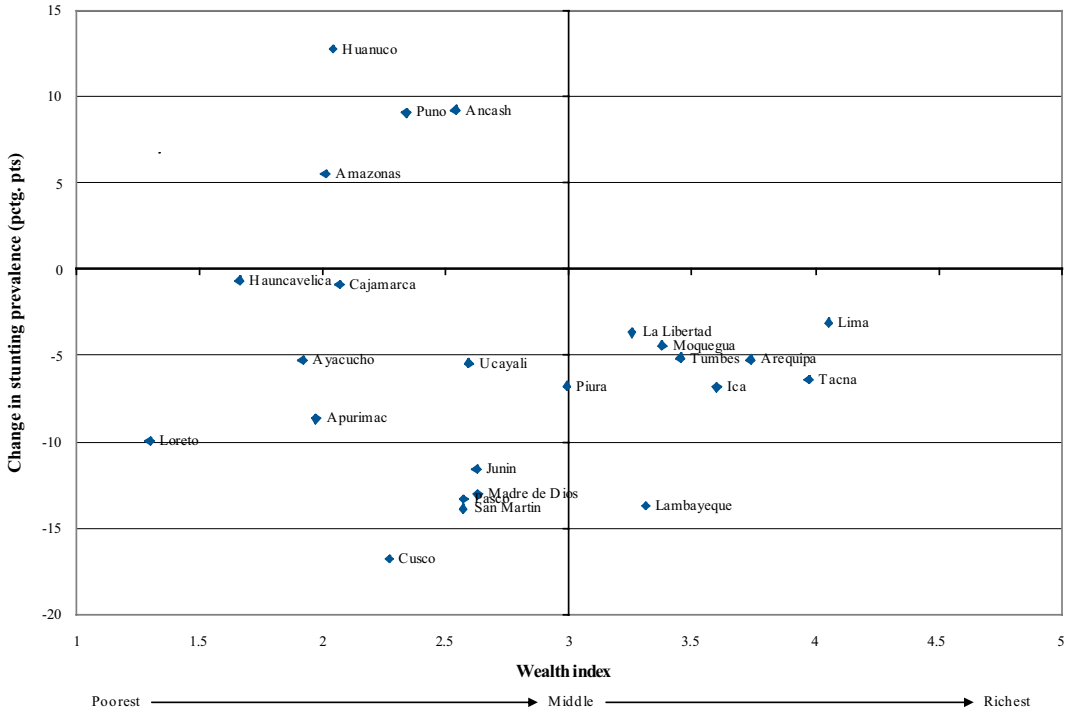


Figure 28. Peru 1986-2005 change in prevalence of stunting by Wealth Index and region



4.6 Achieving MDG 1

As discussed earlier in this document, the best indicator for assessing malnutrition is stunting because it reflects the accumulated, permanent and long-term effects of poor early childhood nutrition. Unfortunately, the official indicator for monitoring achievement of MDG 1 (reducing the prevalence of malnutrition by half between 2000 and 2015) is underweight. The choice of indicator (underweight or stunting) has important implications for determining whether countries are "on track" to meet MDG 1. Using the survey date closest to 2000 as the baseline (range 1998-2002), both the predicted trend (based on the trend in previous years) and target trend (based on the goal of reducing malnutrition by half by 2015) for the prevalence of stunting and underweight were calculated.[1] If stunting is used as the indicator of malnutrition, only four of the 10 countries (the Dominican Republic, Mexico, Nicaragua and El Salvador) are on track to reach the goal (Table 10; Figures 29-38). Colombia could also be on track if it could once again achieve annual percentage point declines similar to those achieved in earlier years, before its rate of decline slowed down. At the current predicted trends in stunting, the remaining 5 countries (Bolivia, Guatemala, Haiti, Honduras and Peru) are not on track to reach the goal.

In striking contrast, if underweight is used as the indicator, nine of the 10 countries analyzed (all countries except Haiti) will be on track to meet their goal, or be within 1 percentage point of the target prevalence (Table 10; Figures 29-38). While underweight may be selected for reporting purposes and comparison with other countries, it is important to note that "achievement" of the targeted goal of reduced malnutrition when using the indicator of underweight, will ignore the significant and remaining burden of stunting. In addition, as stunting is directly related to child mortality, not actively monitoring progress in the reduction of this indicator, will not give a clear picture as to why progress towards MDG 4, may not be occurring.

Regardless of which indicator is used, creating an objective of reducing the mean prevalence of malnutrition by half at the national level ignores the enormous within-country differences in the prevalence of malnutrition and will not identify those regions whose lack of progress may be masked by the progress of better-achieving and better-off regions. Thus, a more appropriate objective may be to set specific prevalence goals by region that takes into account their initial starting point. The goal, for example, could be to reduce by half the prevalence of stunting in each geographic area identified in the survey.

There are several limitations to these analyses. In several of the countries, we did not have a data set from 2000, the baseline year for the MDGs, from which to base our predicted and target trends. We chose the survey that was performed most closely to 2000 as a baseline estimate, a difference that never exceeded 2 years. Our predicted trends are also based on past trends and we cannot foresee whether the same rate of progress will continue to 2015. In addition, our analysis assume that the progress between the first and last survey was linear, which is not always the case. Many countries experienced sharper declines during earlier surveys than in more recent years, so the range of years chosen for determination of the predicted trend could have a large bearing on whether the target prevalence is reached.

1 This analysis was not done for Brazil as there was no survey close to 2000.

Table 10. On track to meet MDG1? Actual, predicted and target trends for underweight and stunting prevalence: WHO Child Growth Standard.

Country	Survey year	Underweight		Stunting	
		Actual trend and predicted prevalence in 2015[1]	Target prevalence in 2015[2]	Actual trend and predicted prevalence in 2015[1]	Target prevalence in 2015[2]
Bolivia	1989	9.04		42.07	
	1994	12.57		34.55	
	1998	6.02		33.48	
	2003	6.02		32.63	
	2015	3.43	3.01	24.54	16.74
Colombia	1986	8.64		26.09	
	1995	6.49		19.88	
	2000	4.96		18.33	
	2005	5.15		16.26	
	2015	3.31	2.48	11.09	9.17
Dominican Republic	1986	9.22		22.35	
	1991	8.53		21.33	
	1996	4.77		13.70	
	2002	4.28		11.79	
	2015	0.27	2.14	3.21	5.90
El Salvador	1993	6.97		26.24	
	1998	8.65		29.47	
	2003	5.49		20.76	
	2015	3.71	4.33	14.18	14.74
Guatemala	1987	27.87		62.39	
	1995	22.00		55.53	
	1999	20.47		53.39	
	2002	18.02		54.47	
	2015	9.49	10.24	47.61	26.70
Haiti	1995	24.22		37.49	
	2000	14.06		28.91	
	2005	19.21		30.13	
	2015	14.20	7.03	22.77	14.46

Continue >

Continue Table 10. On track to meet MDG1? Actual, predicted and target trends for underweight and stunting prevalence: WHO Child Growth Standard.

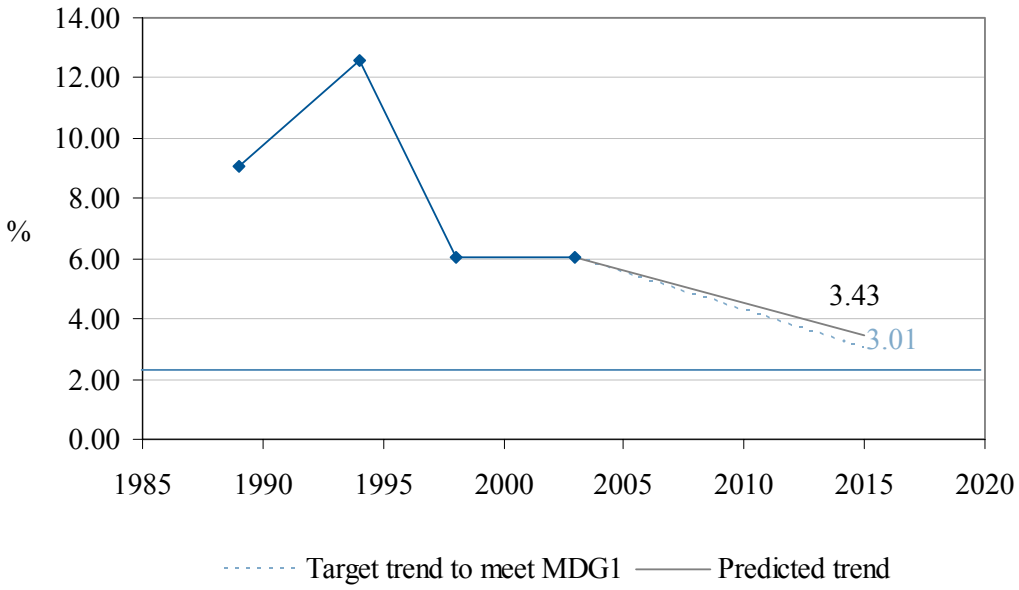
Country	Survey year	Underweight		Stunting	
		Actual trend and predicted prevalence in 2015[1]	Target prevalence in 2015[2]	Actual trend and predicted prevalence in 2015[1]	Target prevalence in 2015[2]
Honduras	2001	12.58		34.55	
	2005	8.72		30.15	
	2015	2.92	6.29	23.54	17.28
Mexico	1988	10.8		26.9	
	1999	5.6		21.5	
	2006	3.4		15.5	
	2015	0	2.8	9.8	10.75
Nicaragua	1998	10.41		30.72	
	2001	7.83		25.37	
	2006	6.90		16.90	
	2015	2.95	3.92	1.36	12.69
Peru	1986	8.91		37.76	
	1996	5.78		31.90	
	2000	5.24		31.63	
	2004-08	5.62		29.83	
	2015	3.89	2.62	25.66	15.82

1 The predicted prevalence in 2015 is estimated by calculating the average annual change (in percentage points) per year between the first and last survey for each indicator in each country, and applying the same rate of decline until 2015.

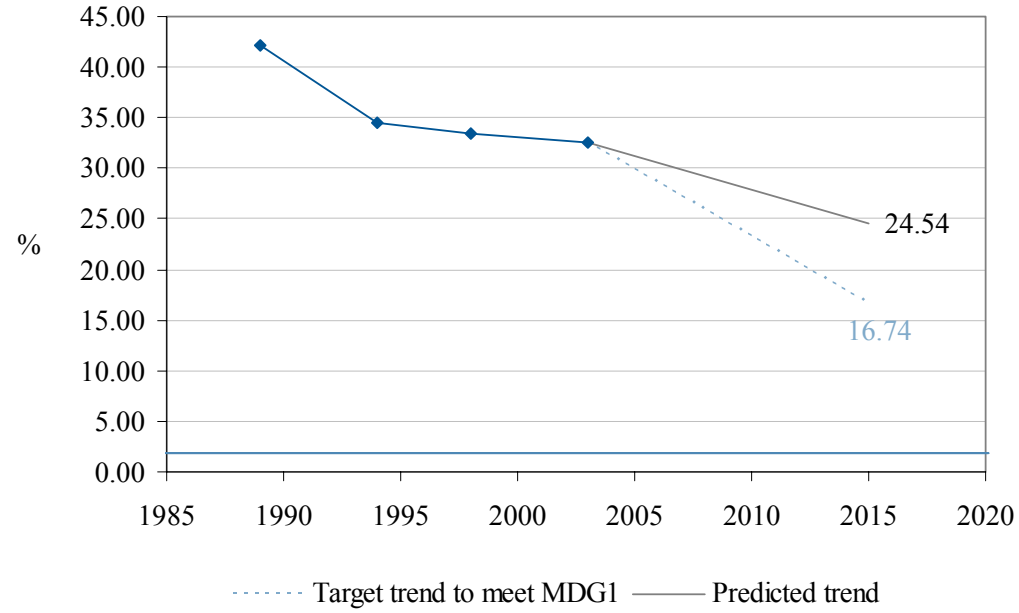
2 The target prevalence in 2015 is calculated as half the prevalence of the specified indicator in 2000 (or the closest survey year).

Figures 29a, 29b. Is Bolivia on track to meet MDG-1? Comparison of underweight (a) vs. stunting (b) as the target indicator. The blue horizontal line on both graphs represents the expected prevalence of underweight/stunting in a normal population.

a. Underweight

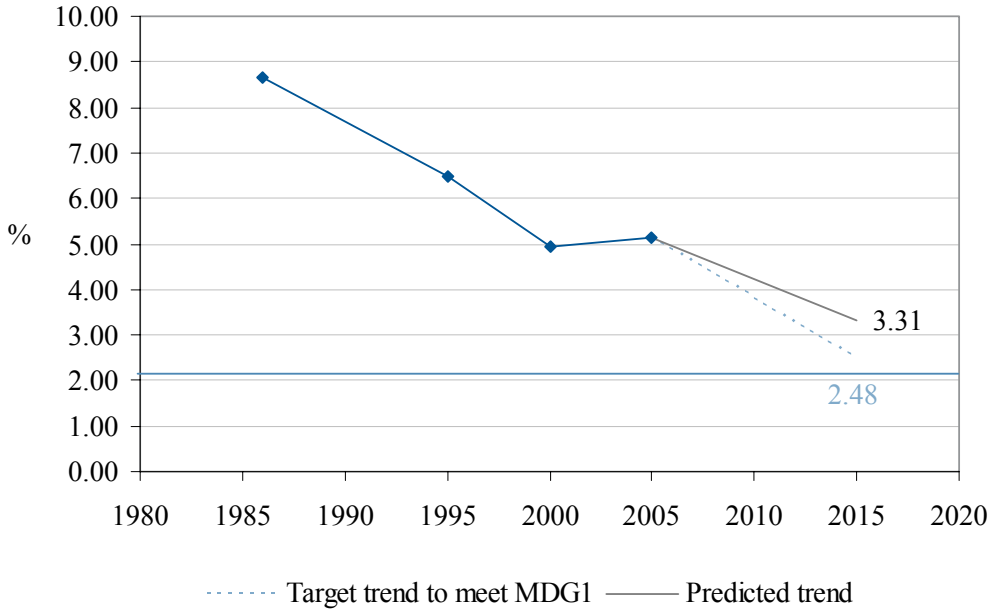


b. Stunting

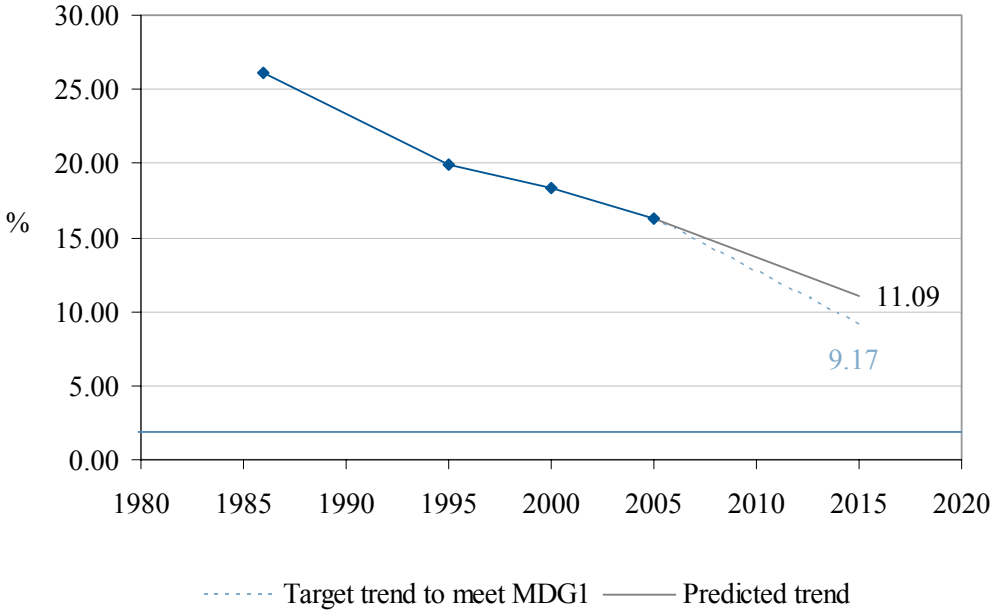


Figures 30a, 30b. Is Colombia on track to meet MDG-1? Comparison of underweight (a) vs. stunting (b) as the target indicator. The blue horizontal line on both graphs represents the expected prevalence of underweight/stunting in a normal population.

a. Underweight

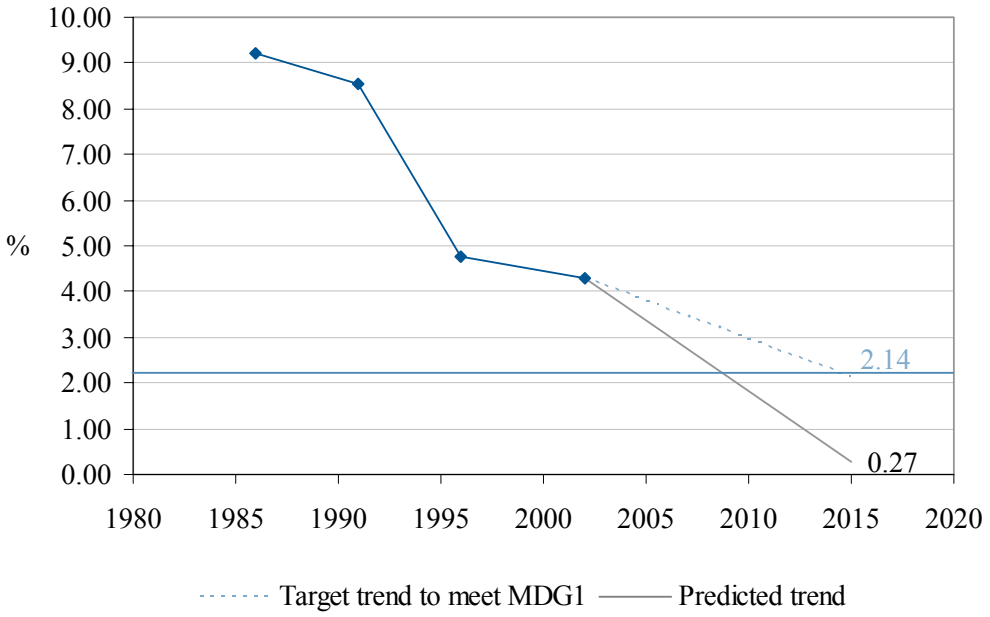


b. Stunting

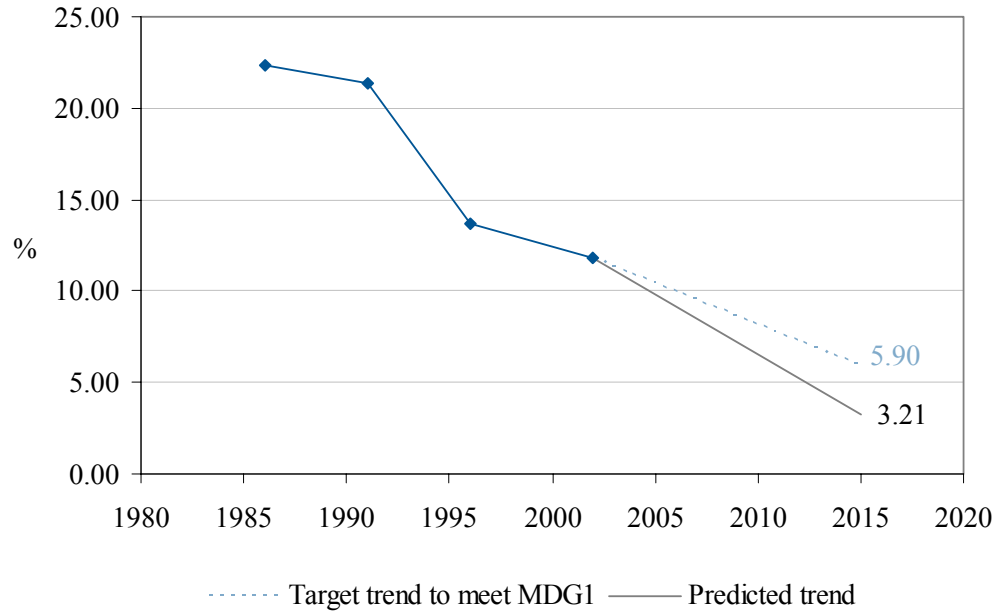


Figures 31a, 31b. Is the Dominican Republic on track to meet MDG-1? Comparison of underweight (a) vs. stunting (b) as the target indicator. The blue horizontal line on both graphs represents the expected prevalence of underweight/stunting in a normal population.

a. Underweight

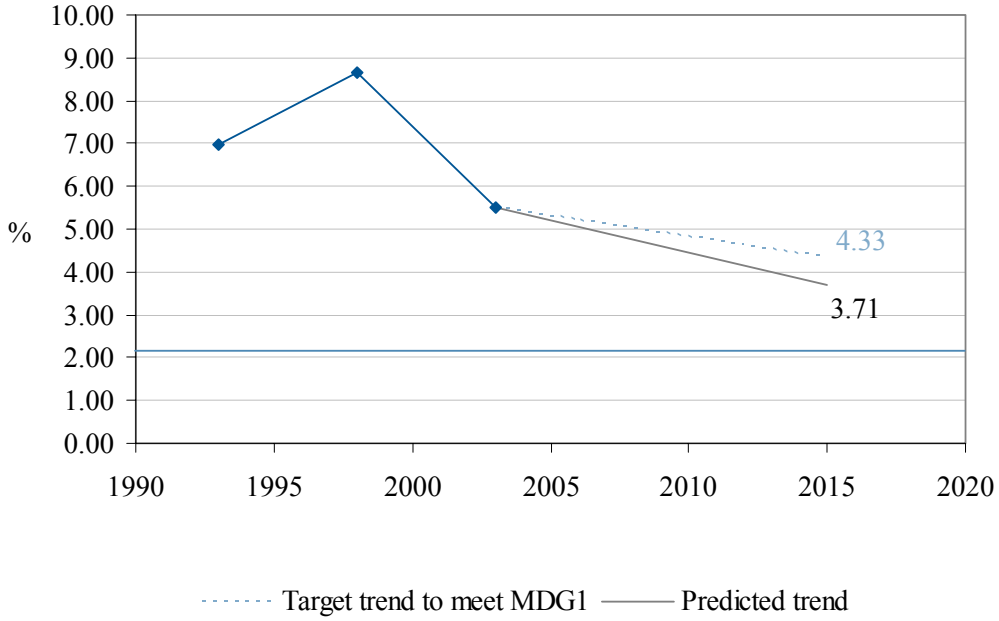


b. Stunting

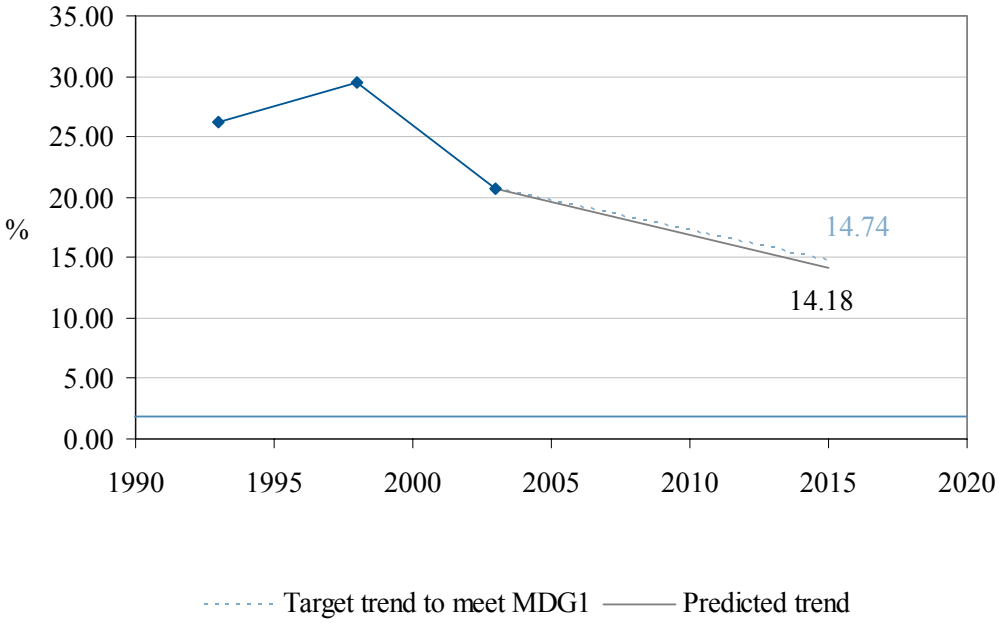


Figures 32a, 32b. Is El Salvador on track to meet MDG-1? Comparison of underweight (a) vs. stunting (b) as the target indicator. The blue horizontal line on both graphs represents the expected prevalence of underweight/stunting in a normal population.

a. Underweight

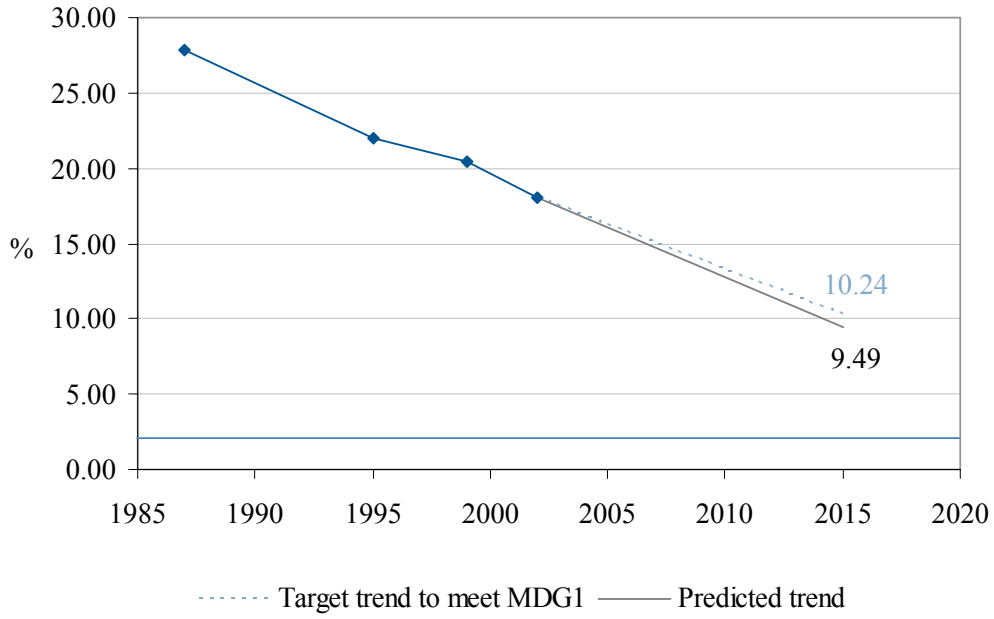


b. Stunting

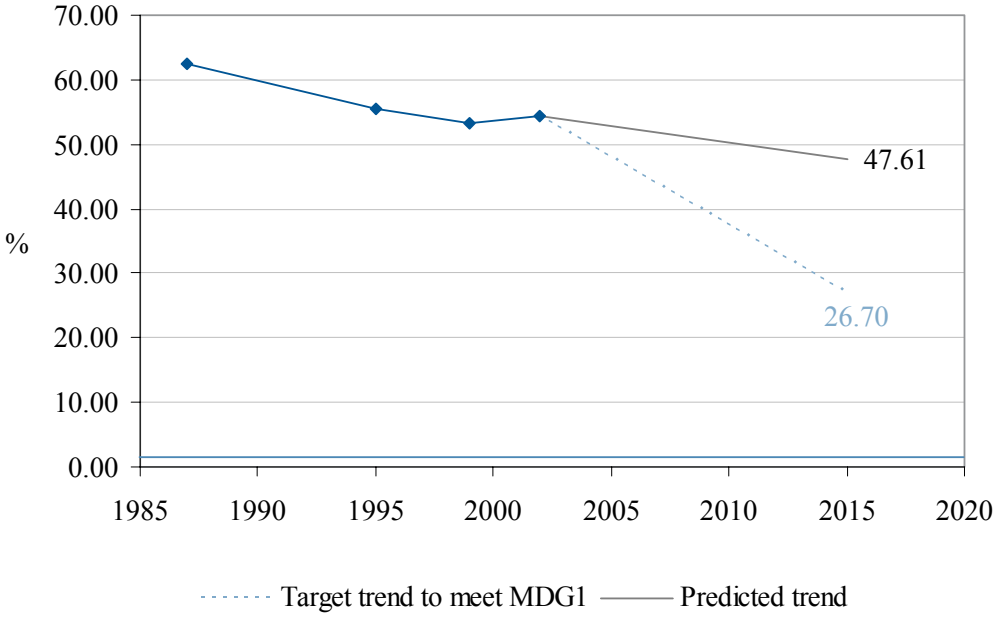


Figures 33a, 33b. Is Guatemala on track to meet MDG-1? Comparison of underweight (a) vs. stunting (b) as the target indicator. The blue horizontal line on both graphs represents the expected prevalence of underweight/stunting in a normal population.

a. Underweight

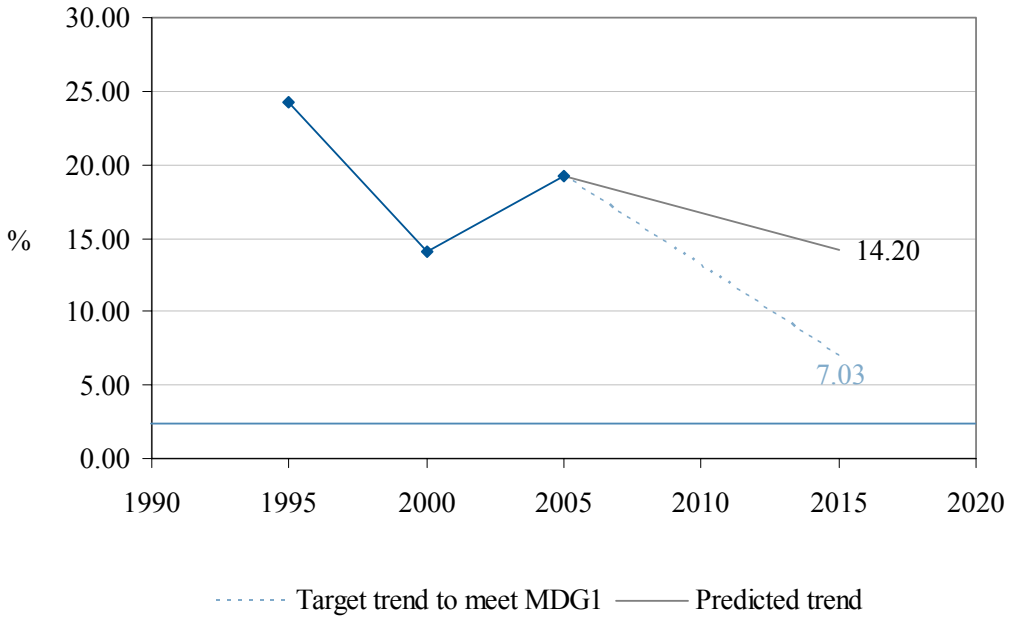


b. Stunting

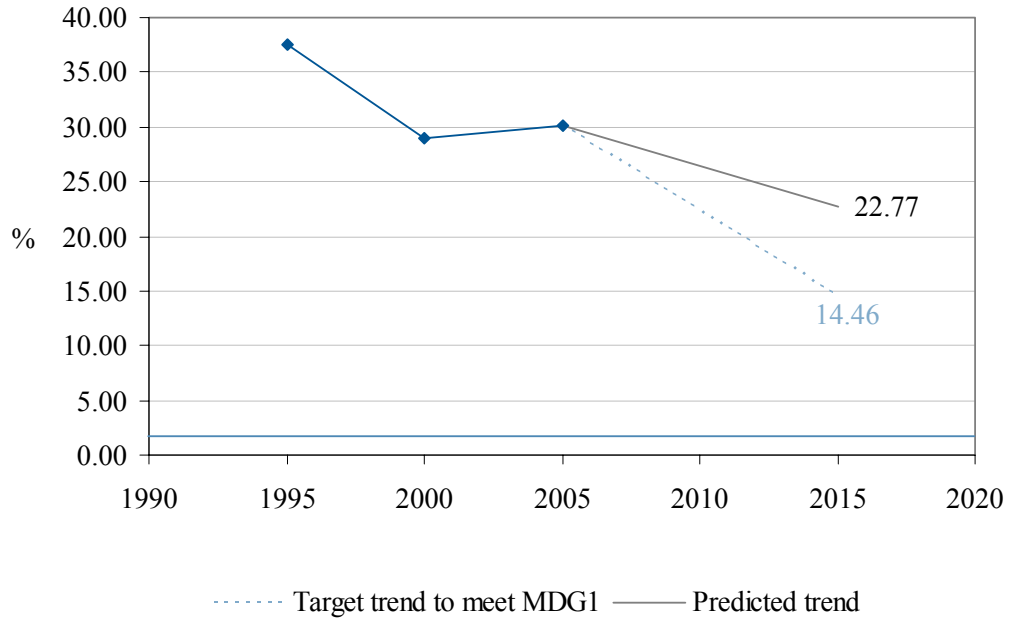


Figures 34a, 34b. Is Haiti on track to meet MDG-1? Comparison of underweight (a) vs. stunting (b) as the target indicator. The blue horizontal line on both graphs represents the expected prevalence of underweight/stunting in a normal population.

a. Underweight

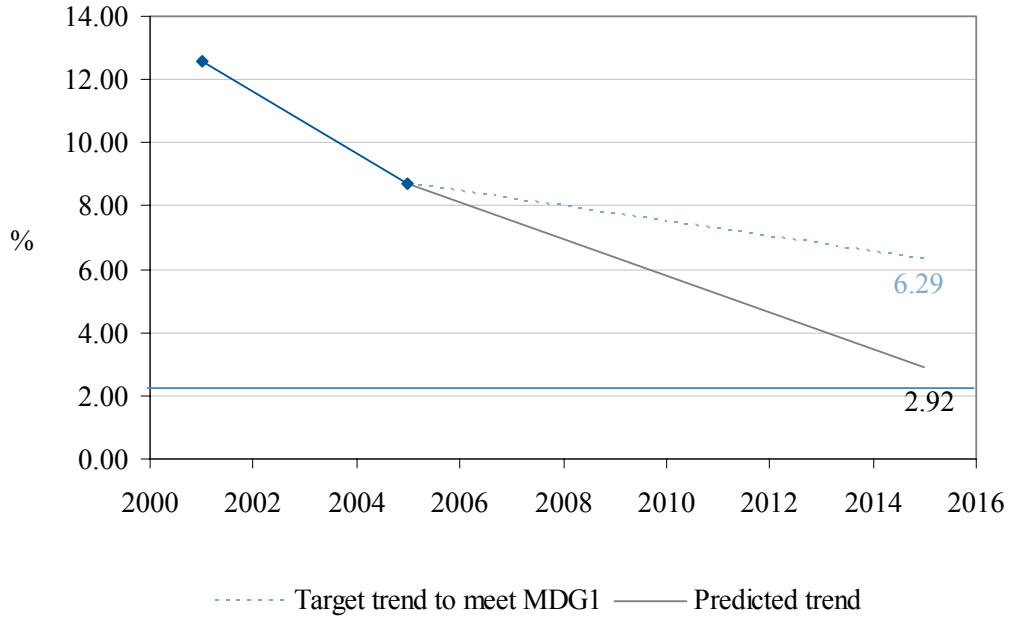


b. Stunting

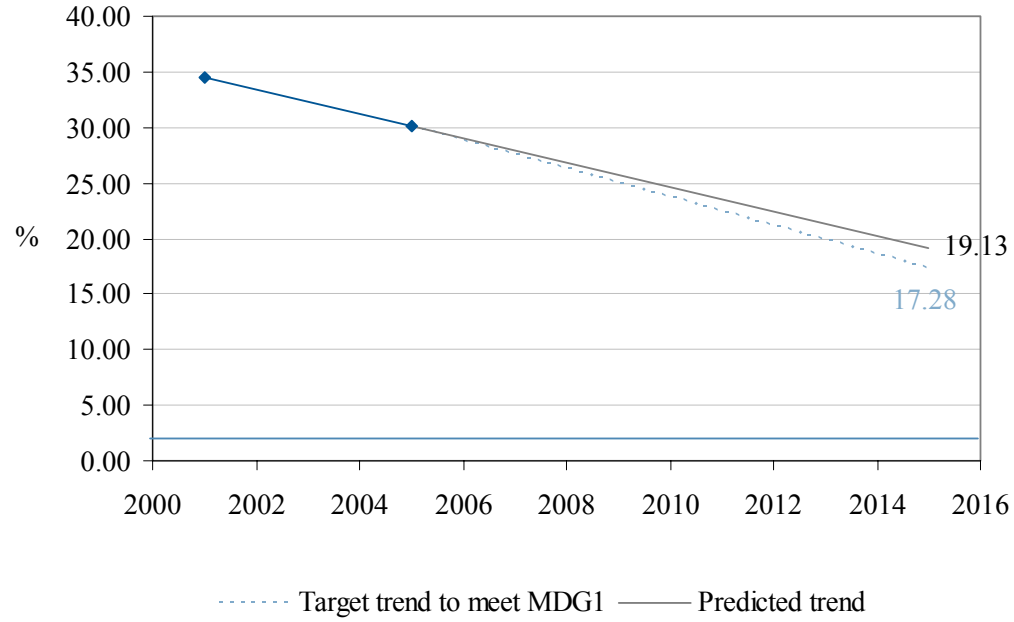


Figures 35a, 35b. Is Honduras on track to meet MDG-1? Comparison of underweight (a) vs. stunting (b) as the target indicator. The blue horizontal line on both graphs represents the expected prevalence of underweight/stunting in a normal population.

a. Underweight

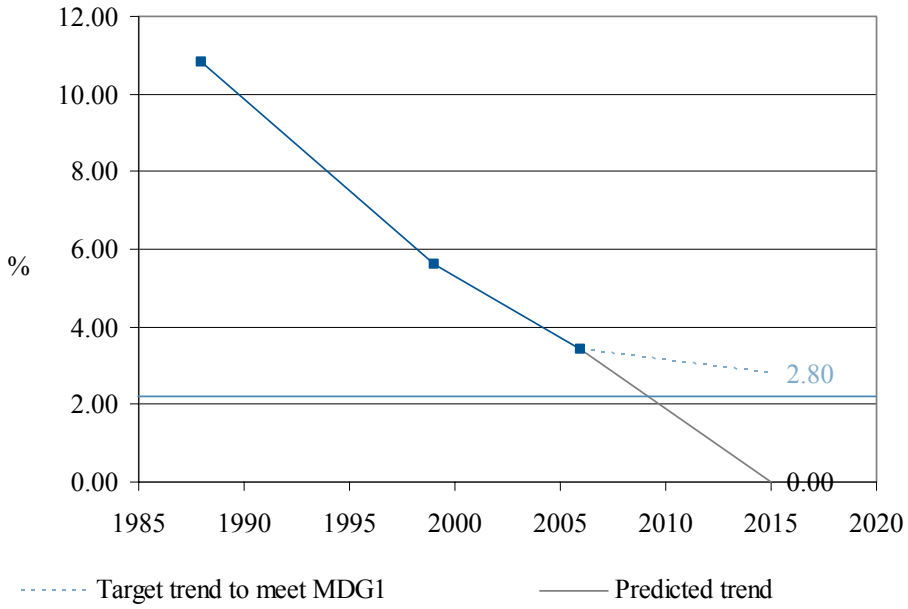


b. Stunting

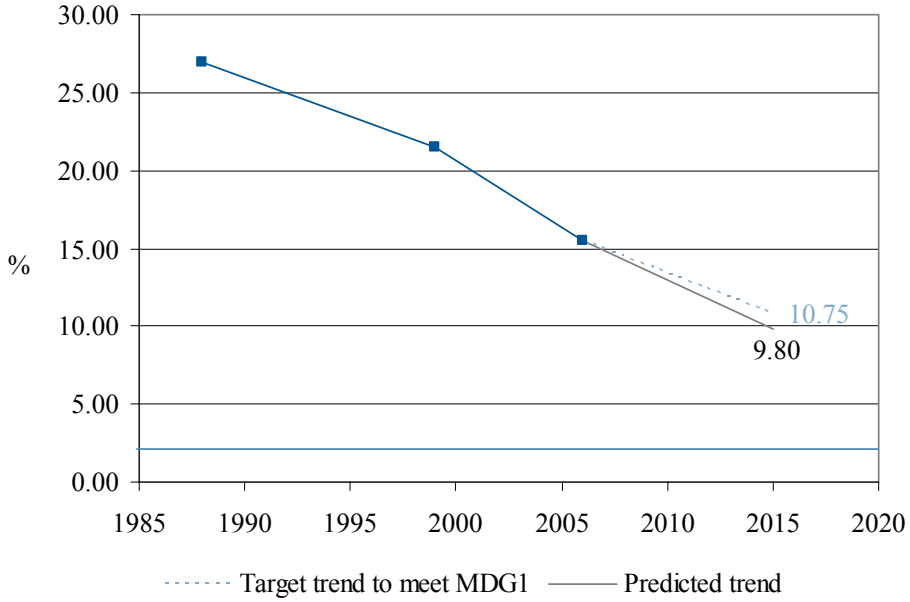


Figures 36a, 36b. Is Mexico on track to meet MDG-1? Comparison of underweight (a) vs. stunting (b) as the target indicator. The blue horizontal line on both graphs represents the expected prevalence of underweight/stunting in a normal population.

a. Underweight

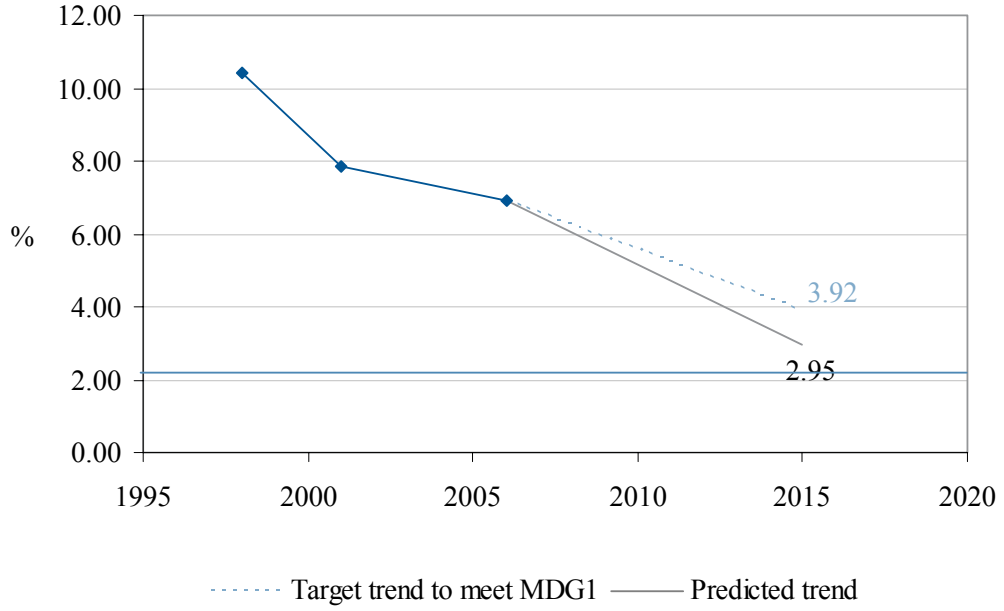


b. Stunting

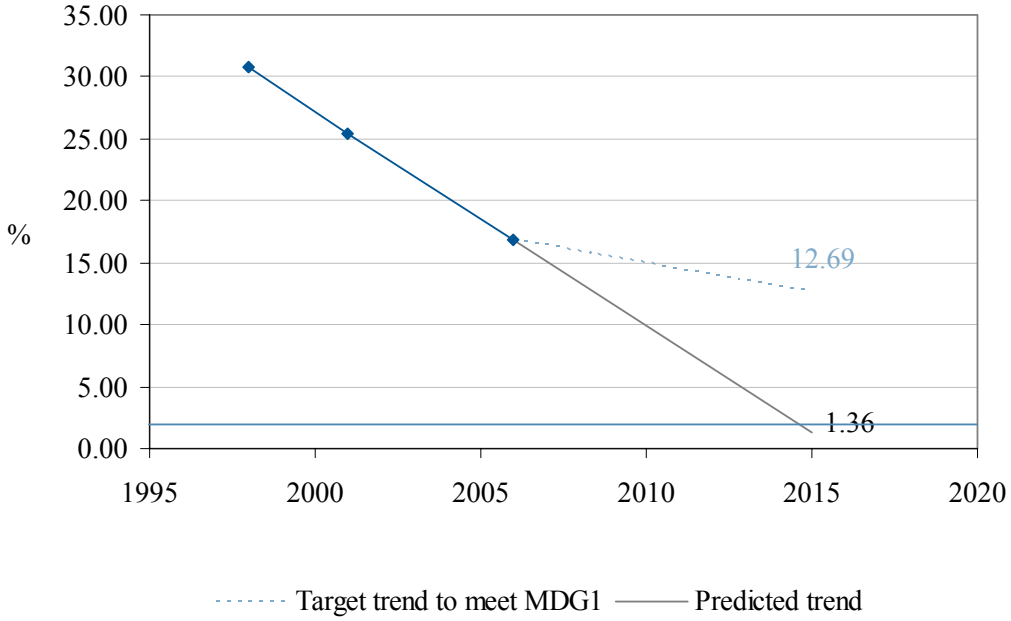


Figures 37a, 37b. Is Nicaragua on track to meet MDG-1? Comparison of underweight (a) vs. stunting (b) as the target indicator. The blue horizontal line on both graphs represents the expected prevalence of underweight/stunting in a normal population.

a. Underweight

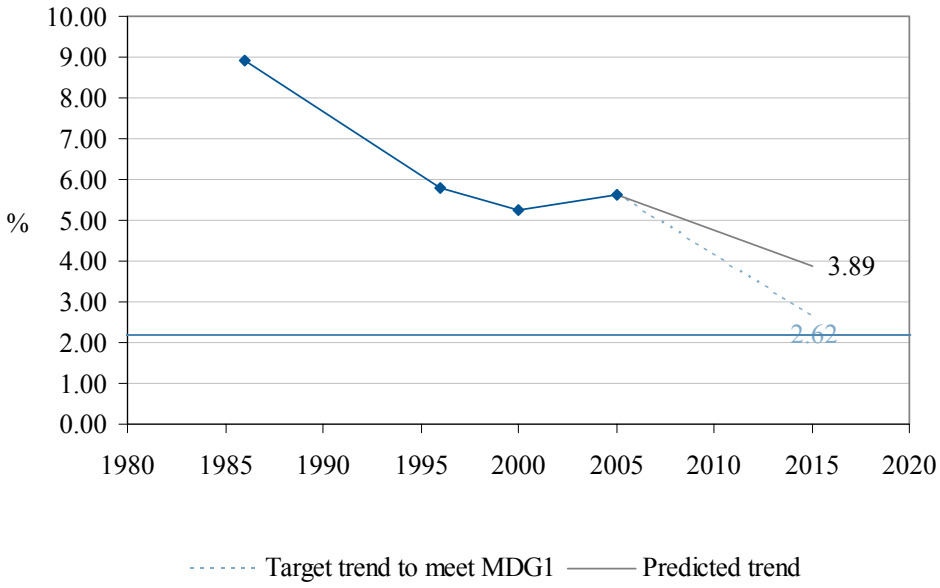


b. Stunting

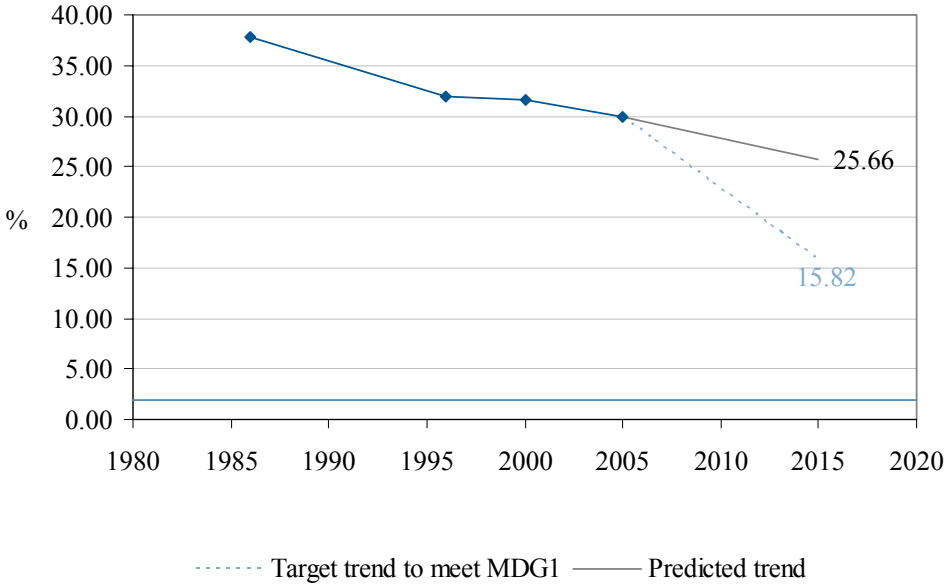


Figures 38a, 38b. Is Peru on track to meet MDG-1? Comparison of underweight (a) vs. stunting (b) as the target indicator. The blue horizontal line on both graphs represents the expected prevalence of underweight/stunting in a normal population.

a. Underweight



b. Stunting



5. Assessing and achieving progress in reducing malnutrition: Implications for programs and policies

Applying the new WHO Child Growth Standards to nationally representative data on child weight and height changes the interpretation of both the nature and magnitude of the problem of malnutrition. In particular, it demonstrates more accurately than does the NCHS reference the gap between the prevalence of stunting and underweight, focusing attention on the problem of dietary quality and high levels of morbidity and possibly intergenerational factors limiting linear growth, rather than the problem of providing enough energy. It also highlights the critical period of the first several months of life when weight gain is not protected from faltering as it appeared to be using the NCHS reference. In addition, it confirms that the first 24 months of life prevent a window of opportunity to prevent post-natal growth failure. In this section we describe the causes of the high prevalence of stunting compared with those of underweight, as well as appropriate short- and long-term interventions for tackling stunting.

5.1 Understanding the causes of malnutrition

Understanding the reasons for the high prevalence of stunting relative to underweight seen in this region as well as in other world regions is important for implementation of both nutrition and non-nutrition interventions that will tackle this particular form of malnutrition effectively. The large prevalence of stunting relative to underweight suggests that energy or "the amount food" is not the main dietary problem. Energy intake, while necessary for linear growth, is not sufficient. While underweight is more readily solved by an increase in caloric intake, improving linear growth will also depend on ensuring appropriate infant feeding practices that address adequate dietary quality (including provision of key micronutrients important for linear growth) in addition to dietary quantity. Postnatal factors also contributing to stunting include poor infant appetite (which is dependent on both the nutritional and health status of the child), inadequate caregiver breastfeeding and complementary feeding behaviors and infectious disease, particularly diarrhea.

As mentioned earlier, complementary feeding diets are well known to be deficient in iron, zinc and vitamin B6 and depending on the country also deficient in riboflavin, niacin, calcium, vitamin A, thiamine, folate and vitamin C. [3] They are typically low in the proportion of energy provided by animal source foods, which decreases the availability of essential fatty acids and amino acids as well as iron and zinc intake. Lack of animal source food, not only contributes to the low content of important micronutrients in typical complementary feeding diets, but may also affect intake through their effect on taste and energy density. Zinc deficiency and possibly other micronutrient deficiencies, including iron, have a negative effect on appetite. [34]. Although foods in addition to breast milk will be needed starting at 6 months of age in order to meet nutrient requirements, introducing them and/or other liquids including water before that time point is a principal cause of

poor linear growth. The early introduction of complementary foods and/or other liquids (i.e. before 6 months of age), which is common in many countries, displaces breast milk and the more bioavailable nutrients it provides. It also increases the chances of infectious morbidity from diarrhea.

Other characteristics of typical complementary feeding diets are important to consider. Sensory characteristics such as sweetness and viscosity will affect intake: increased sweetness appears to increase intake, whereas increased viscosity will decrease the amount of food (and energy) consumed. Energy density, or the amount of calories per quantity of food, will be an important determinant of energy and micronutrient intake. Intake of complementary foods varies directly with their energy density such that children consume more low energy dense food than high energy dense food so as to meet their energy needs [3]. Because of limitations of infant gastric capacity, low energy-dense foods (which are common in complementary feeding diets) will likely not be consumed in sufficient quantities to meet energy requirements for growth.

Feeding behaviors by the caregiver that affect intake by the infant include the level of encouragement provided to the child, the frequency of feeding and feeding in an environment free of distractions. Since the amount of energy needed from complementary foods will vary with breast milk intake (which can have a large inter-individual range), the responsiveness of the caregiver to child cues to hunger and satiety is critical.

Infectious diseases are a principal contributor to stunting during the first 2 years of life. Diarrhea, is thought to have the most important role, because of its effects on not only nutrient loss, but nutrient absorption and appetite as well.[15] The prevalence of diarrhea peaks during this critical period of growth. In a review of the effects of diarrheal incidence on the odds of stunting at 24 months of age, for each episode of diarrhea, the odds of stunting increased by a factor of 1.05. [1] In addition to increasing nutrient losses, diarrhea can reduce intake of complementary food up to 30 %, [15] though it does not affect breast milk intake.[19]

Prevention of intrauterine growth restriction is also important. Preterm birth, a major cause of low birth weight, can be prevented by improved maternity care and early detection and treatment of preeclampsia and urinary and reproductive track infections. Although there is a relationship between maternal pre-pregnancy weight and weight gain during pregnancy and birthweight, the ability to identify nutritionally at-risk women during pregnancy (positive predictive value) is poor. [35] Furthermore, evidence is needed to establish that providing additional food, as some governments in the Regions do, is efficacious and effective in improving fetal growth and/or preventing preterm birth.

In contrast, maternal iron deficiency, the most prevalent micronutrient deficiency during pregnancy and linked to newborn iron status is amenable to intervention. Iron and folic acid supplementation is efficacious and effective in reducing the prevalence of this problem benefiting both the mother and newborn. [36, 37]

5.2 Implications for growth monitoring

Application of the WHO Standards, which revealed that weight loss during the first 6 months of life was previously underestimated, has important implications for community- and facility-based growth assessment programs. The NCHS reference did not pick up this early

faltering and erroneously made it appear that growth in weight was protected during the first several months of life. Appropriate weight gain is necessary for subsequent linear growth.[38] Young children put on weight, thus increasing their weight-for-length, prior to spurts in linear growth; therefore, energy is necessary though not sufficient for optimal linear growth. Because weight gain is more rapid then length gain and weight is easier to assess than length in young infants, changes in weight are more likely to be detected. Therefore, at the community and/or health facility level it is imperative that early faltering in weight be identified through growth assessment.

A key challenge is to better understand if and how including the assessment of length in countries that currently only routinely assess weight helps to identify children who are faltering in growth so that appropriate action can be taken. Many countries in the Region do not routinely measure length and lack measuring boards, training and experience in how to measure length and interpret differences in growth trajectories in weight, length and weight-for-length. Because many children are stunted, low weight-for-age may occur in a child whose weight-for-length/height ratio is normal and unless length is assessed, this child may erroneously be labeled as "malnourished". If he is less than 2 years of age, any intervention to improve his nutritional status should focus on supporting linear growth rather than providing only additional energy. After 2 years of age, interventions should focus on ensuring a balanced diet ensuring a consistent growth trajectory in weight and length, but not "correcting" the underweight as that will only make a permanently stunted child heavier.

Another key challenge is training health workers to understand the difference between a growth trajectory (sequence of measurements plotted on a growth chart) and a classification of nutritional status (e.g. wasted). For the individual child, the most important classification of nutritional status is with respect to identifying severe wasting (weight-for-length/height <-3 SD) as this is a life-threatening condition that requires immediate medical attention.[39] In the Region, severe malnutrition is a rare condition though contributes substantially to young child mortality because of its high case-fatality rate. In contrast, many young children are classified as underweight (weight-for-age <-2 SD) even when their weight-for-length is normal as some countries do not routinely assess linear growth. Unfortunately, the focus on "counting the malnourished" for surveillance system reporting has confused the true purpose of growth assessment in primary health care, which is to monitor growth trajectories and provide sound advice about breastfeeding, complementary feeding, hygiene and care.

5.3 Short-term approaches for reducing stunting

Prevention of stunting will require both short- and long-term approaches.[40] In the long term, improvements in the underlying determinants of malnutrition, which include poverty, low maternal education, high morbidity and lack of women's empowerment are necessary and will have lasting effects. In the short-run, however, to prevent postnatal stunting, greater attention needs to be placed on 1) early initiation of breastfeeding; [39, 41, 42] 2) improving the duration of exclusive breastfeeding; 3) improving complementary feeding behaviors and foods; and, 4) reducing the incidence of infectious morbidity, particularly diarrheal morbidity. The major challenge is to improve linear growth (reduce stunting) without disproportionately increasing weight in relation to length/height. Thus, interventions should focus on promoting exclusive breastfeed-

ing for the first 6 months of life and continued breastfeeding until 2 years of age or more.

To ensure a supportive environment for appropriate young child feeding, care and nutrition, it is important that policies and programs are put in place and enforced to ensure that the appropriate young child feeding and care choice is also the "easy choice". Many examples of successful programs to improve young child feeding and nutrition exist.[43] For example, the International Code of Marketing of Breast-milk Substitutes and subsequent relevant World Health Assembly Resolutions, [44] maternity legislation, the Baby Friendly Hospital Initiative (BFHI), [45] and community-based counseling to ensure a propitious environment for optimal breastfeeding and complementary feeding practices are basic to providing a favorable environment for improved young child nutrition.

5.3.1 Breastfeeding

Breastfeeding promotion is the most effective intervention for preventing child mortality, [1, 2, 8] and also has many other short and long-term benefits for maternal and child health. [46, 47] It is also extremely cost-effective relative to other child health interventions. [8] International concern about declining rates of breastfeeding in the 1970s [48] led to a concerted effort by the international donor community to invest in breastfeeding promotion [49]. In Latin America, the duration of BF increased between the late 1970s and late 1990s, despite concurrent changes in population characteristics that typically have a negative effect on breastfeeding.[50, 51] In particular, interventions such as training of health care providers, improving hospital practices, educating and counseling mothers and public education campaigns are linked to measurable and large improvements in BF duration. [52]

Since these gains in breastfeeding duration occurred, investment in breastfeeding promotion, protection and support has waned and this is reflected in stagnating or even downward trends in some countries. Furthermore, the gains that were made were not equitable in that the largest increases in breastfeeding duration were among well-educated, urban women with access to health care.[53] To ensure that breastfeeding practices are improved so that the benefits to young child survival (MDG 4) and nutrition (MDG 1) are realized, it is necessary to increase investment to breastfeeding programs and increase political advocacy of their importance. Breastfeeding promotion, protection and support must placed back on top of the international and national health agendas, where it belongs.

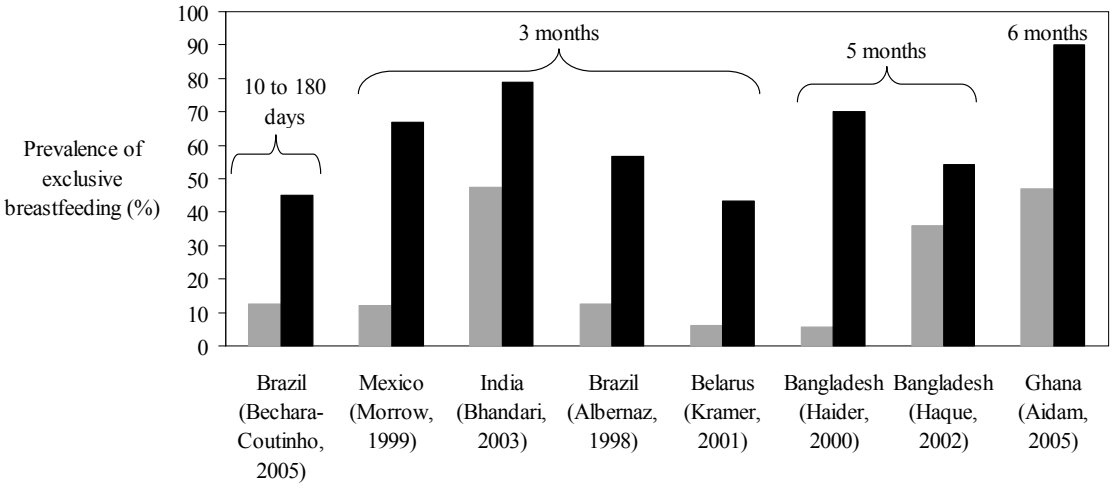
Key instruments to promote, protect and support breastfeeding include the International Code of Marketing of Breast-milk Substitutes [44]and subsequent relevant World Health Assembly Resolutions and the BFHI. [54] In Latin America, the Network of Human Milk Banks (Red Latinoamericano de Bancos de Leche Humana) is also being used to revitalize breastfeeding. To maximize the contribution that the Code can make to improved breastfeeding, given the many examples of non compliance, [55, 56] in-country monitoring of its implementation must be carried out. Companies found to be committing violations must be sanctioned by the government entity charged with Code enforcement. Ensuring that all companies that produce infant formula compete for market share in a manner consistent with the Code will benefit these companies by ensuring that no company is given an unfair advantage.

The BFHI is effective in improving breastfeeding. [57, 58] However, it needs to be revitalized with a systematic recertification process to ensure that its rigorous standards are upheld.

Many certified hospitals no longer meet the certification criteria and require recertification. Revitalization of the BFHI requires capacity building in breastfeeding counseling and the clinical aspects of lactation management. To enforce the monitoring of the BFHI criteria on a routine basis, consideration should be given to making fulfillment of the criteria a part of the overall system of quality certification of hospitals, which occurs in all countries, rather than left as a vertical intervention as originally conceived. Human milk banks can also serve as a center for breastfeeding activities, in addition to providing breast milk for critically ill newborns.

One-on-one breastfeeding counseling has proven to be particularly effective in promoting exclusive breastfeeding, the breastfeeding pattern most predictive of infant survival and health. The results of 8 randomized controlled trials show that maternal counseling at key moments during lactogenesis and when mothers switch to mixed feeding has large and significant effects on exclusive BF (Figure 39.) [5, 6, 36, 59-64]) The trials in India and Belarus, which were implemented in the context of on-going health services and therefore more likely to be replicated, are particularly important. They also reached relatively large numbers of women, approximately 17,000 mother-infant pairs in Belarus and 1,000 in India. In contrast, the other trials involved smaller numbers of women and were implemented as efficacy trials with paid and well-trained and paid counselors. All the trials show that individual breastfeeding behaviors are amenable to change by counseling. The key public health challenge is how to integrate such counseling, which is often delivered in the women's home, into primary health care.

Figure 39. Importance of health-worker training and lactation counseling after hospital discharge for the duration of exclusive breastfeeding: Results of 8 studies



Control groups (did not receive any additional post-hospital discharge breastfeeding support through the study) are shown in the hatched bars. Intervention groups, which included some form of post-discharge peer-counseling breastfeeding support (often through home visits) are shown in solid bars. The prevalence of EBF at each study's endpoint is noted; for the study from Brazil, the mean aggregated prevalence over the period between 10 and 180 days is presented.

5.3.2 Complementary feeding

Improving complementary feeding and demonstrating its impact on young child nutrition has been challenging, [31], though a recent comprehensive review shows examples of successful programs. [65] Global guidelines for complementary feeding of both the breastfed and non-breast fed child have recently been developed and virtually all countries in the Region have national guidelines. However, there is very little information on how national guidelines are implemented and their efficacy or effectiveness. Unlike breastfeeding, where messages are universal (e.g. initiate within the first hour of birth, breastfeed exclusively for 6 months and continue with complementary feeding for two years or more, breastfeed on demand, etc), most counseling around complementary feeding is not universal, but child-specific and based on his growth pattern. There is little evidence that such child-specific counseling is effective, though few good evaluations exist. On exception is in Brazil, where child-specific messages implemented through the IMCI program were effective in improving weight though not length. [66] A different model of counseling, that of program-specific messages where all caregivers of children less than 2 years of age receive the same set of standard messages has been effective in improving linear growth in two settings (Peru and China). [7, 67] The messages in both these settings were based on formative research showing what foods are accessible and culturally acceptable to feed young children. Program-specific messages have the advantage in that they can be disseminated at both health facilities and in communities through community organization such as cooperatives, the church and women's clubs, among others. [68, 69]

Many countries in the Region provide cereal-based fortified complementary foods to young children starting at 6 months of age. [70] Fat-based spreads fortified with micronutrients also have large effects in improving linear growth, iron status and gross motor development. [71] Such supplements should be preferentially targeted to children 6 to 24 months of age and only extended beyond that age if data show continued linear growth faltering (in order to reduce the risk of making short children heavier). Although few children are severely malnourished in the Region, they are at very high risk of mortality if not treated properly. Ready-to-use therapeutic foods (RUTF) are therefore important to manage severe malnutrition (weight-for-length/height <-3 SD) in both facility- and community-based programs.[72] An important goal for the Region would be the elimination of severe malnutrition (weight-for-length/height <-3 SD).

5.4 Long-term approaches

The underlying social determinant of stunting is poverty, which includes lack of access to land and/or steady wage labor, low maternal education,[73] substandard or non-existent water and sanitation services [74](resulting in high levels of early childhood morbidity) [19, 75], and lack of women's empowerment. These determinants are outside the mandate of the health sector, illustrating the importance of active and effective coordination among different ministries including agriculture, labor, education, water and sanitation and gender in addressing the underlying causes of stunting.

Of the determinants mentioned above, the role of mother's education merits particular attention. [76] In general, the largest gap in stunting prevalence is between children of mothers with primary and secondary education. From our analyses it cannot be determined if it is the actual level of maternal education or its association with socio-economic status

(or potentially many other factors associated with maternal education) that is driving this relationship, although research has shown that maternal education, independent of wealth, does play a positive role in child nutrition.[76] Therefore, as levels of maternal education continue to improve in the region it is likely that child nutrition will improve as well. However, given the large gaps between children of women with no or primary education versus secondary and post-secondary education, efforts need to be especially targeted to improve the nutrition of children of less-educated mothers, who may not otherwise reap the full benefits of nutritional interventions.

5.5 Integration with primary health care

To achieve adequate coverage, the interventions described above must be integrated into maternity and delivery, neonatal and child health care in the context of primary health care. Integration of young child feeding and nutrition into such programs as the Integrated Management of Childhood Illnesses (IMCI) is important as this is the mechanism through which young child health care is delivered in many countries. [77] Improving infant and young child nutrition must be a priority for all health personnel-- not limited to the domain of nutritionists-- and they must have the knowledge and technical skills needed to appropriately counsel mothers on breastfeeding and complementary feeding and treat illnesses that lead to poor nutrition. Nurses and physicians could be motivated through highlighting evidence of the importance of young child feeding and nutrition for child health [78, 79] and including relevant technical material in the curricula of nursing and medical schools.

Given the importance of early childhood nutrition to achieving MDGs 4 and 1, early childhood feeding and nutrition can no longer by on the margin of discussions about maternal and child health but an integral part of all child survival strategies. Particularly in Latin America, where large gains have been made in reducing infant mortality, the critical role of early childhood nutrition in taking infants "beyond survival" should not be ignored.[80] Also, early initiation of breastfeeding prevents neonatal mortality,[41, 42] where infant mortality is increasingly concentrated. Lastly, investing in and improving monitoring and evaluation programs is essential to monitor progress and make necessary policy and program adjustments.

5.6 Reducing inequities

Equity is an important public policy goal. [81] To reduce the gross inequities in the Region, the health and social determinants of malnutrition must be addressed simultaneously through the comprehensive implementation of the short- and long-term interventions described above. These must be targeted to the communities with the highest prevalences of stunting, which are often the most difficult and expensive to reach. Targeting of pregnant women and infants and young children in these communities should be preventive and universal in nature as by the time stunting is diagnosed the "window of opportunity" for its prevention may have passed. [82] As current food prices rise and food insecurity increases among more vulnerable groups, the disparities in nutritional outcomes between wealthier and poorer segments of society, are likely to be exacerbated. While impoverished rural areas will continue to be at high-risk, impoverished urban areas where families purchase all their food will be increasingly affected. Thus, appropriate targeting mechanisms to reach the most vulnerable segments of society and programs to

ensure adequate food will need to become an immediate reality in order to prevent deterioration of overall nutritional outcomes and the worsening of outcomes in already marginalized groups.

The greatest challenge will be translating the political commitment to reduce inequities into policies and programs that engage the poorest communities from the very beginning as a key stakeholder in developing the set of solutions to their problems. Political rhetoric must be transformed into concrete actions that reach all pregnant women and young children, especially the poorest, most marginalized and hardest to reach. Investing in and improving monitoring and evaluation programs will also be essential to monitor progress, make necessary policy and program adjustments, assess impact and the cost of the results achieved. [83, 84]

Conclusions

The fight against malnutrition is essential to achieve nearly all of the MDGs and is occurring in a politically important and strategic moment in history. Many Member States are committed at the highest political levels to eradicate stunting in young children. This commitment reflects an understanding of the importance of young child nutrition for physical and mental health throughout life, and for social and economic development generally. It also reflects the knowledge that there are evidence-based cost-effective preventive interventions, which will result in increased physical growth, cognitive development, educational achievement and economic productivity.

Enormous inequities in malnutrition primarily in the form of stunting continue to exist within and among countries in the Region of the Americas. Not surprisingly, overall country prevalence estimates mask enormous within-country differences, which in percentage points are largest for stunting. Measuring progress toward achieving MDG 1 should be assessed on reducing stunting by 50% not only at the aggregate national level by 2015, but reducing it by this amount in each geographic sub-region identified in country surveys and among indigenous populations. Several countries have been successful in virtually eliminating young child malnutrition. Others are on track to reduce stunting by 50% from levels in 2000 by 2015 and have made great strides in reducing inequities in stunting. This shows that both stunting and inequities can be reduced, providing young children with hopes for a better future.

Development and dissemination of macro policies targeting critical nutrition- issues relevant to stunting is necessary. Many countries have formed an inter-sectoral high-level committee to convene and coordinate different sectors at both national and local levels to implement a national strategy and plan of action to improve young child nutrition. A strategy is also needed to ensure the universal application of highly effective nutrition interventions in primary health care and to guarantee universal access to vulnerable groups and populations. To reduce the gross inequities in the Region, efforts must be targeted to the communities with the highest prevalences of stunting, which are often the most difficult and expensive to reach.

Investing in capacity in public health nutrition is needed to ensure that countries have updated knowledge in technical advances, effective policies and programs and monitoring and evaluation strategies in child nutrition. Investing in information, knowledge management and evaluation systems is also necessary. Public health decisions should be data-driven and guided by operation's research that provides answers on whether programs work; why they work and how much they cost. Funds for monitoring and evaluation should be included in every program budget and sufficient to ensure useful results for decision making. Evaluations are needed to provide a rational basis for defending and expanding--and when necessary--changing programs to improve young child nutrition. They also serve to hold all stakeholders, including program beneficiaries, accountable.

The development and dissemination of guidelines, tools and effective models to reduce stunting is also necessary. Guidelines, tools and models for how to improve young child nutrition must be continuously updated with

respect to scientific changes in our understanding of the causes and consequences of young child nutrition and empirical knowledge from program evaluations. Most importantly, this information must be integrated into medical, nursing and health policy curricula. To reach political and non technical audiences, advocacy materials based on sound science are needed and a communication strategy to reach these audiences developed.

Existing and newly created partnerships and networks can be mobilized to reduce stunting. There is a need to harness and coordinate the actions of all stakeholders, including a strategic alliance among the United Nations Agencies to optimize technical cooperation on young child health and nutrition, as well as a coordinating mechanism among bi-lateral agencies, non governmental organizations (NGOs), faith-based organization, foundations and public-private partnerships. Sharing of experiences among countries (e.g. South-SouthCooperation) can also be fostered to exchange lessons learned, strategic directions and evaluation strategies.

In conclusion, MDGs 4 and 1 will only be achieved if infant and young child feeding and nutrition are no longer on the margins of discussions and cease to be neglected by country development strategies and investments in maternal, neonatal and child health. Success will depend on early childhood feeding and nutrition—breastfeeding and complementary feeding—becoming an integral part of all maternal, neonatal, infant and child health strategies to prevent mortality and promote optimal development.

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Additional Resources

In addition to the references listed above, the following websites may provide additional information on the topics discussed in this document. All websites are current as of June 2008.

General Nutrition Resources

Academy for Educational Development (AED) Center for Nutrition

http://www.aednutritioncenter.org/the_center

Description: "The AED Center for Nutrition is dedicated to bringing about positive changes in the actions of individuals, communities and institutions that will improve the health and well-being of nutritionally vulnerable populations around the world." Website provides links to AED areas of expertise within nutrition including: food security, infant and young child feeding, vitamin A and other micronutrient deficiencies, application of computer-based advocacy models for nutrition, community therapeutic care for management of severe acute malnutrition, infant feeding in the context of HIV and nutritional care and support of people with HIV/AIDS.

WHO: Nutrition

http://www.who.int/nutrition/en/

Home page for the Nutrition program within WHO. Provides links to specific areas of nutrition (micronutrients, food security, growth) as well as for different age groups (pregnant women, infants, adolescents).

Child Growth Resources

WHO Child Growth Standards

http://www.who.int/childgrowth/en/

In addition to the Growth Standards, the website provides links to information on the Multicentre Growth Reference Study, publications, methods and development of the standards, training resources and software developed by WHO (WHO Anthro) for use on personal computers and mobile devices.

WHO global database on child growth and malnutrition

http://www.who.int/nutgrowthdb/database/en/index.html

Provides country information on available child malnutrition data.

My Future in my First Centimeters (World Bank-Peru, Crecer)

Video (English): http://www.youtube.com/watch?v=mJieb2Xgt9U

Video (Spanish): http://youtube.com/watch?v=tFxZ8YAcYoo&feature=related

A video produced by the World Bank-Peru comparing the growth of children and the growth-monitoring strategies of two different Peruvian villages. Advocates "nutrition education for parents as key elements in preventing malnutrition".

Breastfeeding and Complementary Feeding Resources

The Baby-Friendly Hospital Initiative, (BFHI)

http://www.who.int/nutrition/topics/bfhi/en/
http://www.unicef.org/nutrition/index_24806.html

WHO publications on infant and young child feeding

http://www.who.int/nutrition/publications/infantfeeding/en/index.html

Includes updated materials (January 2006) for Baby-Friendly Hospital Initiative implementation (training of health workers and policy-makers, with additional sections for settings with high HIV prevalence); the International Code of Marketing of Breast Milk Substitutes; and publications on breastfeeding and complementary feeding.

Indicators for assessing infant and young child feeding

http://www.who.int/child_adolescent_health/topics/prevention_care/child/nutrition/indicators/en/index.html

The document provides "8 core and 7 optional indicators for assessing feeding practices in children 0-24 months of age. It includes an update of indicators presented in the WHO/UNICEF document Indicators for assessing breastfeeding practices (1991), as well as important new indicators for assessing feeding practices in children 6-24 months of age." Developed as a result of a "collaborative effort of the International Food Policy Research Institute, the University of California at Davis, the Food and Nutrition Technical Assistance Project, USAID, WHO and other partners" and "reflects the conclusions of a consensus meeting hosted by WHO in Washington in November 2007."

LINKAGES

http://www.linkagesproject.org/

The United States Agency for International Development (USAID) funded the 10-year LINKAGES Project (1996–2006) to provide technical information, assistance and training to organizations on breastfeeding, related complementary feeding and maternal dietary practices and the lactational amenorrhea method. Though no longer being updated, the website includes assessment, training, counseling and monitoring and evaluation tools for infant and young child feeding.

Importance of Nutrition for Health and Development and Achievement of the Millennium Development Goals

"Repositioning Nutrition as Central to Development: A strategy for large-scale action", The World Bank, 2006

Download text: http://siteresources.worldbank.org/NUTRITION/Resources/281846-1131636806329/NutritionStrategy.pdf

Video presentation and powerpoint:

http://www1.worldbank.org/hdnetwork/external/he/mshekar.htm

Text excerpt: "Malnutrition remains the world's most serious health problem and the single biggest contributor to child mortality. Nearly one-third of children in the developing world are either underweight or stunted and more than 30% of the developing world's population suffers from micronutrient deficiencies… It has long been known that malnutrition undermines economic growth and perpetuates poverty. Yet the international community and most governments in developing countries have failed to tackle malnutrition over the past decades, even though well-tested approaches for doing so exist. The conse-

quences of this failure to act are now evident in the world's inadequate progress toward the Millennium Development Goals (MDGs) and toward poverty reduction more generally. Persistent malnutrition is contributing not only to widespread failure to meet the first MDG—to halve poverty and hunger—but to meet other goals in maternal and child health, HIV/AIDS, education and gender equity…"

Pan American Health Organization's Regional Strategy and Plan of Action on Nutrition in Health and Development

http://www.paho.org/english/gov/cd/CD47-18-e.pdf

Other Related Health Issues for Infants and Children: Infectious Morbidity, Environmental Health, Water and Sanitation

Integrated Management of Childhood Illness (IMCI)

http://www.who.int/child_adolescent_health/topics/prevention_care/child/imci/en/index.html

"IMCI is an integrated approach to child health that focuses on the well-being of the whole child. IMCI aims to reduce death, illness and disability and to promote improved growth and development among children under 5 years of age. IMCI includes both preventive and curative elements that are implemented by families and communities as well as by health facilities."

WHO: Children's environmental health

http://www.who.int/ceh/en/

Program that provides resources and information related to addressing "children's health problems resulting from exposure to biologically contaminated water, poor sanitation, indoor smoke, rampant disease vectors such as mosquitoes, inadequate food supply and unsafe use of chemicals and waste disposal." Also provides capacity building tools for health professionals to learn to recognize environmental risk factors for children's diseases.

WHO: Water, Sanitation and Hygiene

http://www.who.int/water_sanitation_health/en/

Resources, training materials and publications on water quality and water-related disease.

Appendix 1

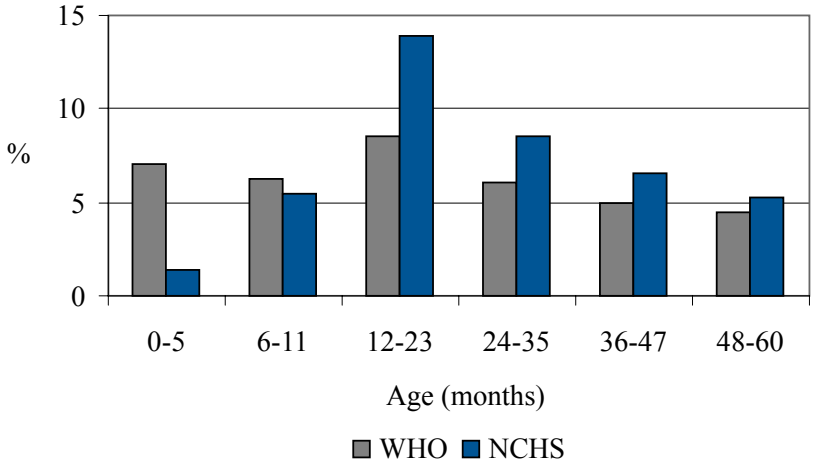
Bolivia, 2003

Table 1.1: Anthropometric data by reference (WHO vs. NCHS), residence, infant sex, region, and age groups

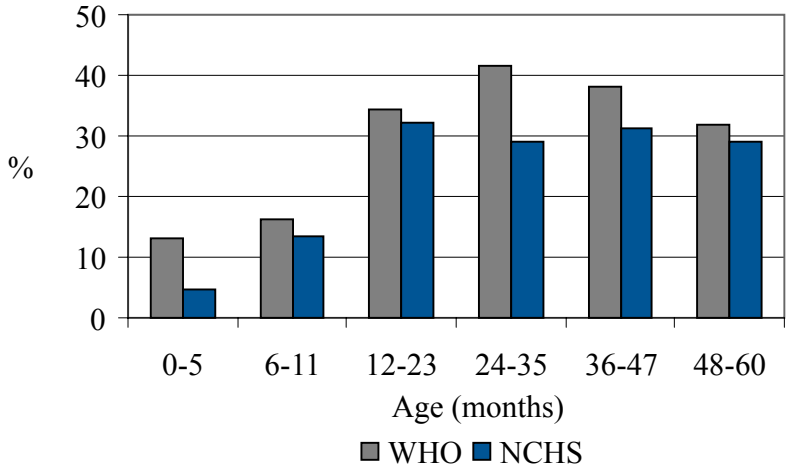
	Weight-for-age		Length/height-for-age		Weight-for-length/height			
	% <-3 SD	% < -2 SD	% < -3 SD	% < -2 SD	% < -3 SD	% < -2 SD	% >+2 SD	% >+3 SD
Reference								
WHO	1.63	6.02	11.38	32.63	0.65	1.75	9.30	2.05
NCHS	1.20	7.56	8.00	26.78	0.33	1.25	5.73	1.70
Residence								
Urban	0.89	3.82	7.45	24.21	0.44	1.58	9.32	2.15
Rural	2.60	8.90	16.55	43.70	0.93	1.98	9.29	1.92
Sex								
Male	1.78	6.22	11.89	33.66	0.72	1.94	9.24	2.23
Female	1.47	5.81	10.85	31.55	0.57	1.55	9.37	1.86
Region								
Chuquisaca	1.94	7.10	17.73	42.93	0.49	0.91	7.50	0.72
La Paz	0.99	5.47	12.45	35.15	0.30	0.93	9.72	2.20
Cochabamba	2.61	7.39	12.94	34.87	0.73	1.82	8.46	1.17
Oruro	0.41	4.48	12.35	42.14	0.21	0.88	9.32	2.09
Potosi	3.38	11.27	20.11	48.73	0.42	1.05	10.45	2.43
Tarija	0.69	3.47	7.89	23.27	1.01	2.48	11.61	2.80
Santa Cruz	0.94	3.51	3.87	17.80	0.72	2.61	8.55	2.29
Beni	3.11	8.51	12.15	37.45	2.67	4.67	12.65	4.28
Pando	0.91	5.41	16.13	33.02	2.18	3.10	14.52	4.18
Age (WHO)								
0-5 mo	1.74	7.06	4.04	12.99	1.84	4.97	17.86	5.77
6-11 mo	2.53	6.25	4.68	16.17	1.00	3.33	12.45	3.49
12-23 mo	2.96	8.50	14.56	34.51	0.76	2.08	7.31	1.60
24-35 mo	1.28	6.06	15.49	41.57	0.65	1.46	8.07	1.79
36-47 mo	1.31	4.94	13.71	38.15	0.34	0.93	9.81	1.69
48-60 mo	0.75	4.44	8.44	31.80	0.30	0.78	7.52	1.17
Age (NCHS)								
0-5 mo	0.27	1.42	1.10	4.65	0.37	1.36	18.12	5.82
6-11 mo	1.26	5.50	2.10	13.35	0.83	2.16	10.99	4.47
12-23 mo	3.03	13.90	9.81	32.25	0.64	2.15	4.45	1.02
24-35 mo	1.20	8.56	10.15	28.91	0.18	1.21	2.20	0.86
36-47 mo	0.65	6.51	9.98	31.15	0.15	0.82	4.23	0.80
48-60 mo	0.49	5.29	7.52	29.11	0.14	0.57	5.01	1.35

Figures 1.1-1.4: Comparison of the prevalence of underweight, stunting, wasting and overweight using the WHO Standard vs. the NCHS reference, overall and by age group

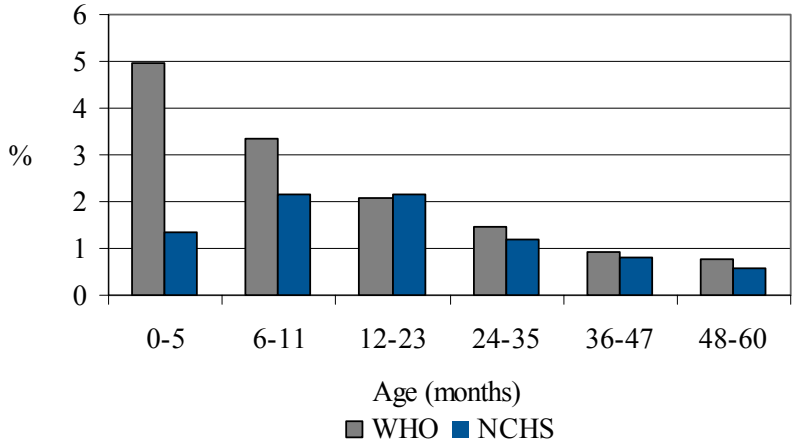
1.1 Bolivia, 2003: Comparison of prevalence of underweight using the WHO standard vs. NCHS reference



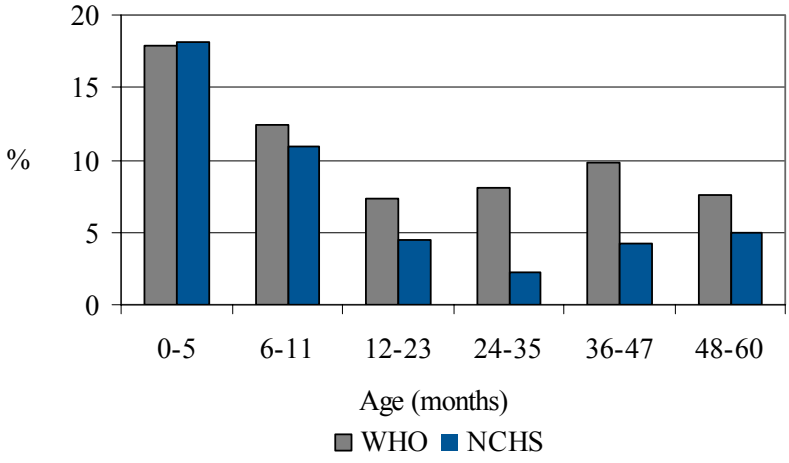
1.2 Bolivia, 2003: Comparison of prevalence of stunting using the WHO Standard vs. NCHS reference



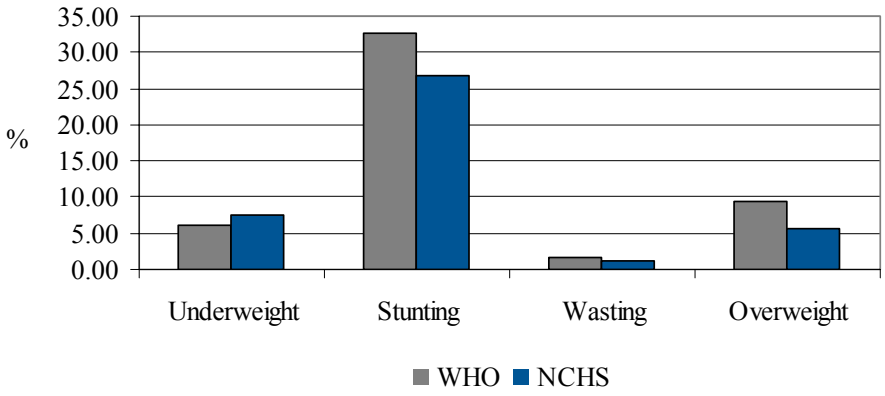
1.3 Bolivia, 2003: Comparison of prevalence of wasting using the WHO Standard vs. NCHS reference



1.4 Bolivia, 2003: Comparison of prevalence of overweight using the WHO Standard vs. NCHS reference

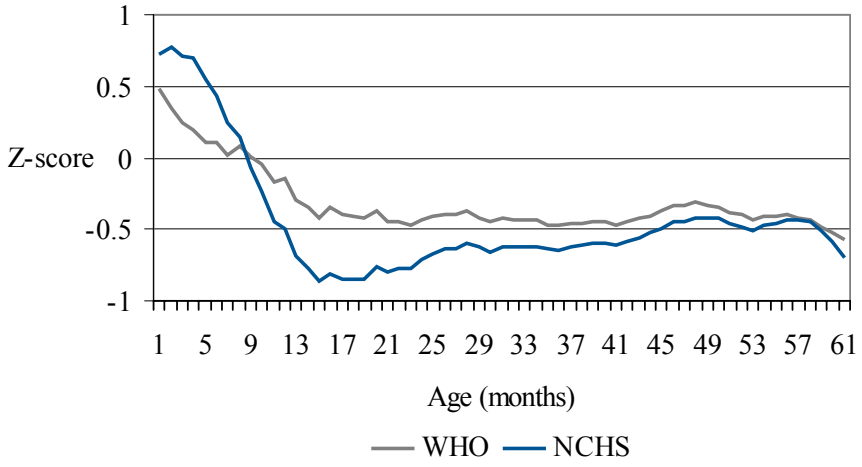


1.5 Bolivia, 2003: Comparison of prevalence of underweight, stunting, wasting and overweight

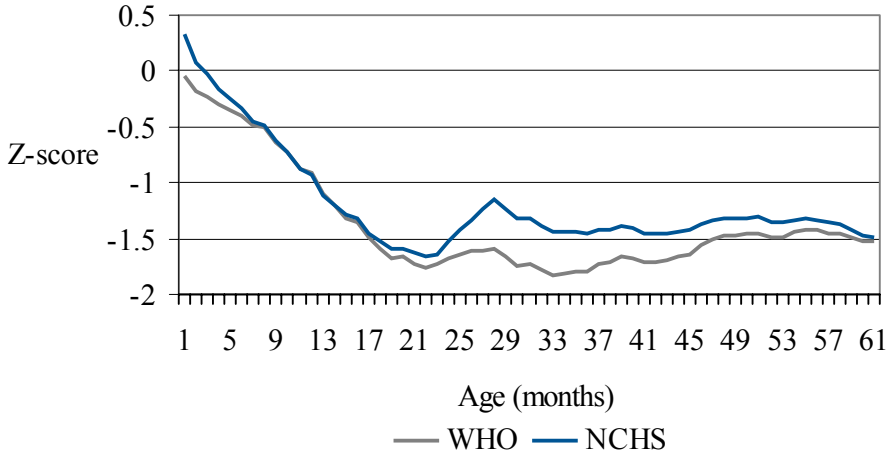


Figures 1.6-1.8: Comparison of five-month moving average Z-scores at each age using the WHO Standard vs. the NCHS reference

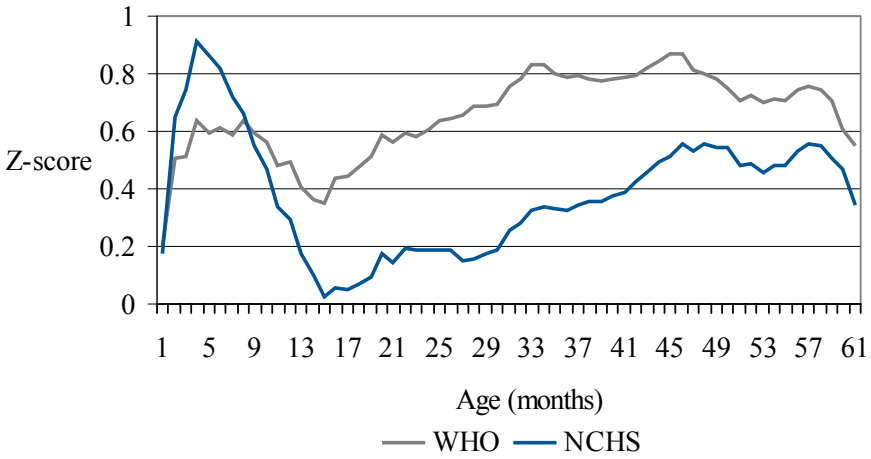
1.6 Bolivia, 2003: Moving average weight-for-age Z-score using the WHO Standard vs. NCHS reference



1.7 Bolivia, 2003: Moving average length/height-for-age Z-score using the WHO Standard vs. NCHS reference

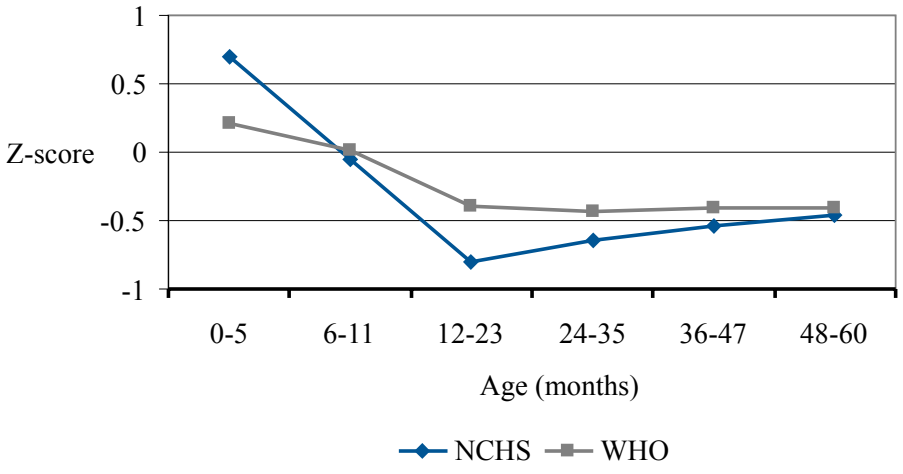


1.8 Bolivia, 2003: Moving average weight-for-length/height Z-score using the WHO Standard vs. NCHS reference

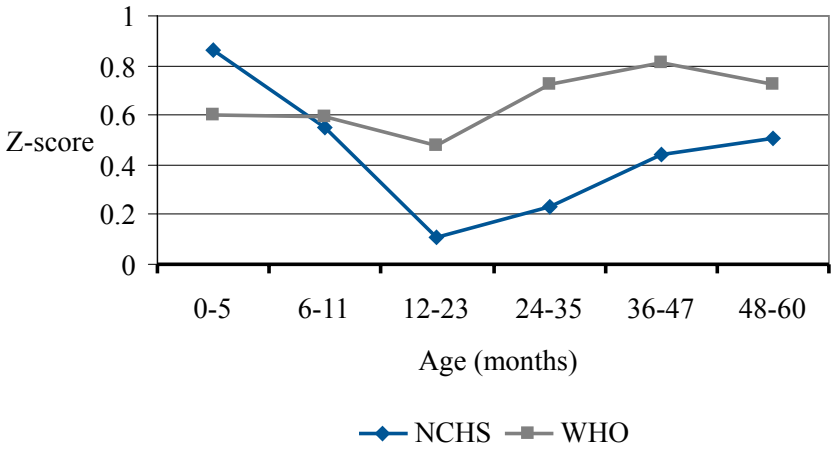


Figures 1.9-1.11: Comparison of mean Z-scores by age group using the WHO Standard vs. the NCHS reference

1.9 Bolivia, 2003: Comparison of mean weight-for-age Z-score by age groups using the WHO Standard vs. NCHS reference



1.10 Bolivia, 2003: Comparison of mean length/height-for-age Z-score by age groups using the WHO Standard vs. NCHS reference



1.11 Bolivia, 2003: Comparison of mean weight-for-length/height Z-scores by age groups using the WHO Standard vs. NCHS reference

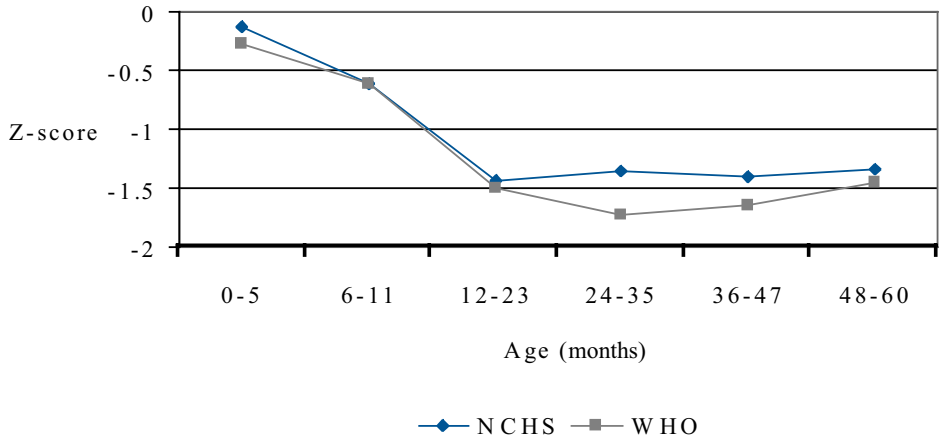


Figure 1.12: Five-month moving average for all anthropometric indicators using the WHO Standard, Bolivia 2003.

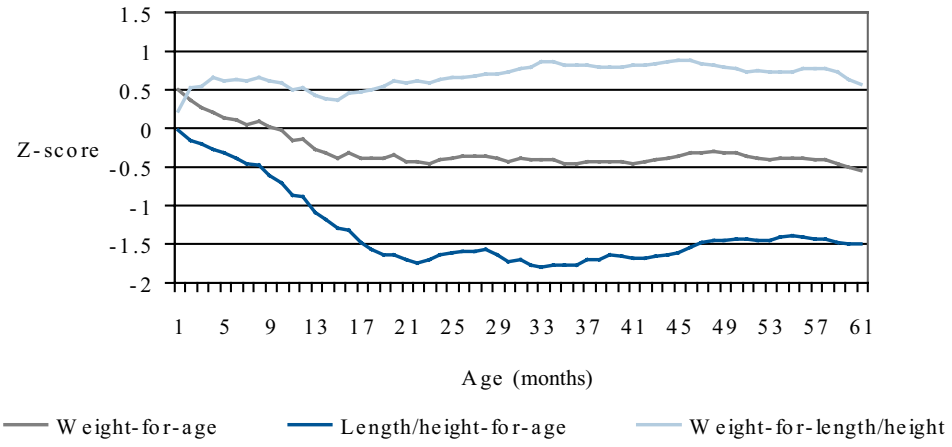
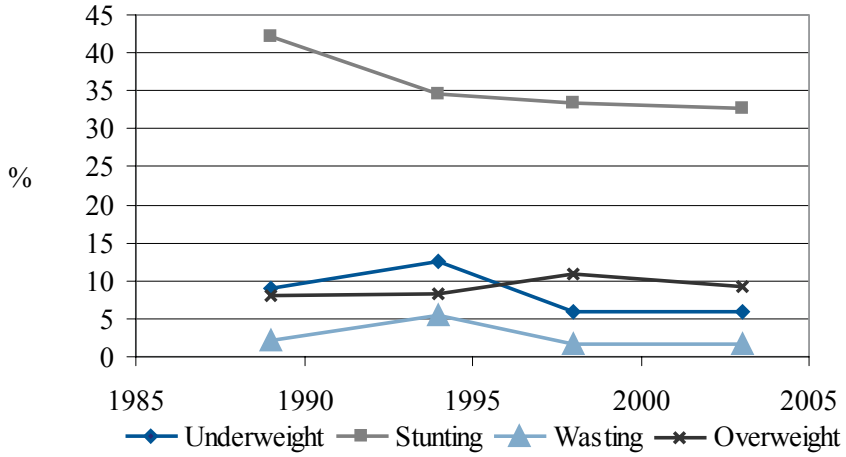
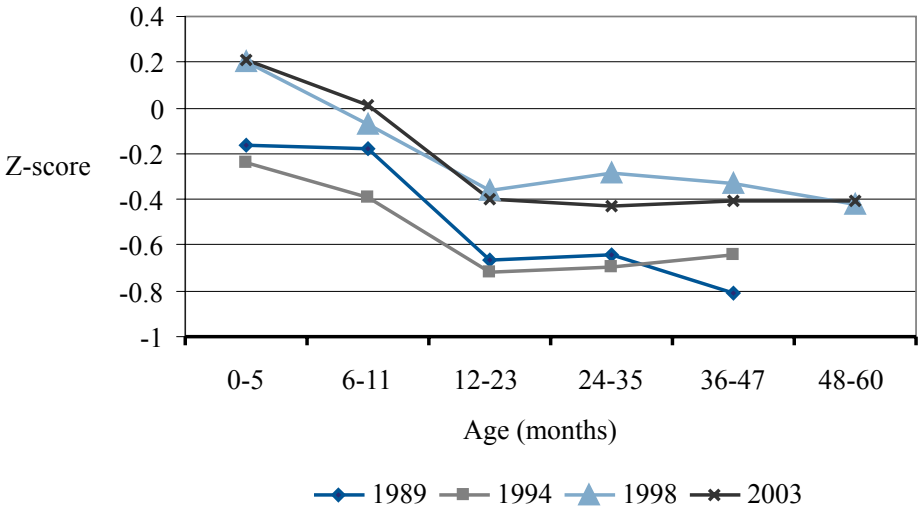


Figure 1.13: Trends in prevalence of all anthropometric indicators for children under five, 1989-2003.

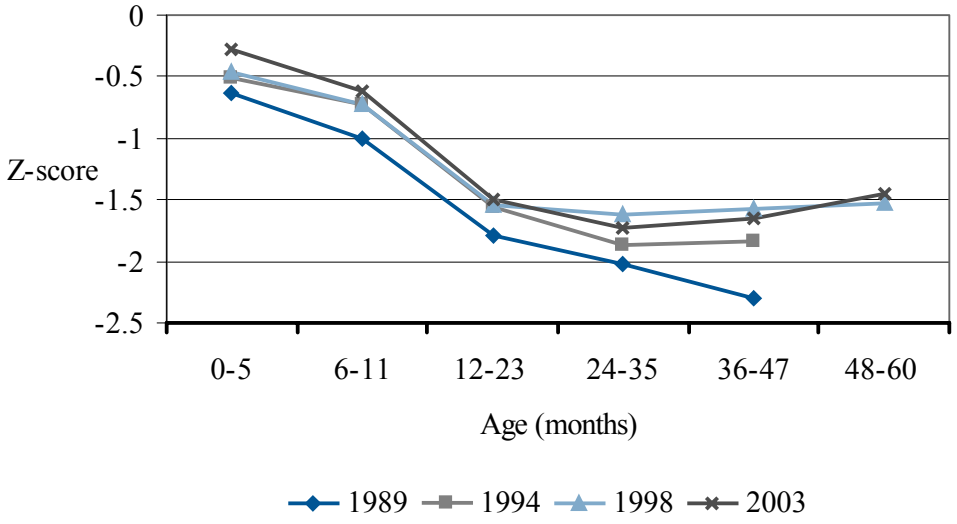


Figures 1.14-1.16: Trends in mean Z-scores by age groups, 1989-2003

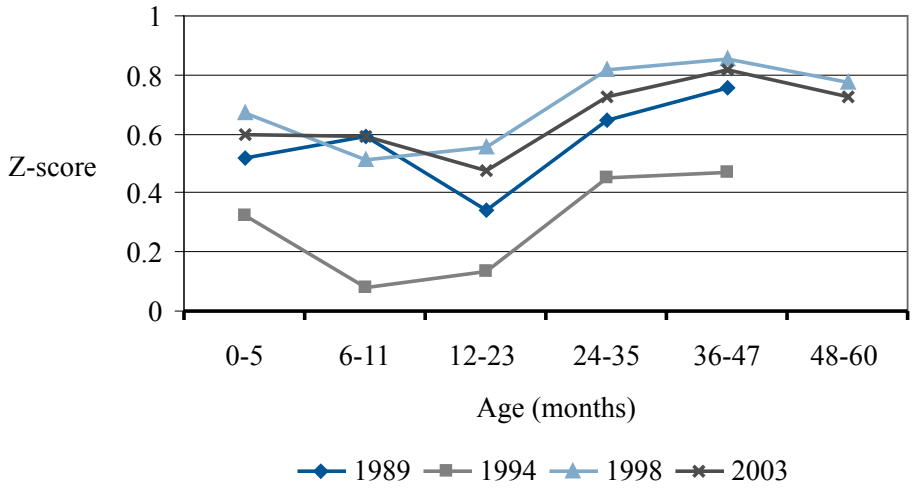
1.14 Bolivia: Trends in mean weight-for-age Z-score by age group and survey year



1.15 Bolivia: Trends in the mean length/height-for-age Z-score by age group and survey year

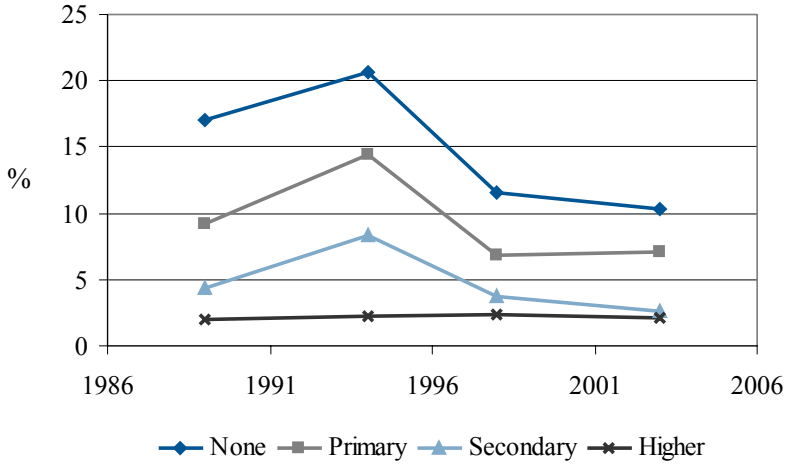


1.16 Bolivia: Trends in the mean weight-for-length/height Z-score by age group and survey year

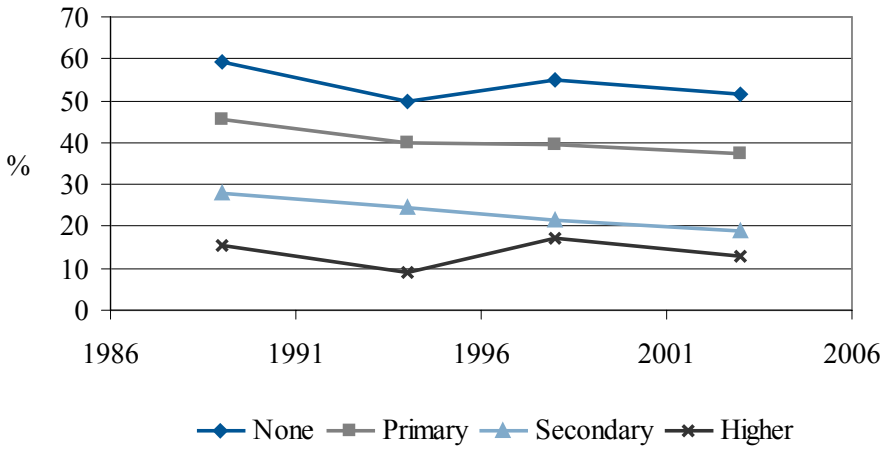


Figures 1.17-1.19: Trends in the prevalence of all anthropometric indicators by highest level of maternal education attained, 1989-2003

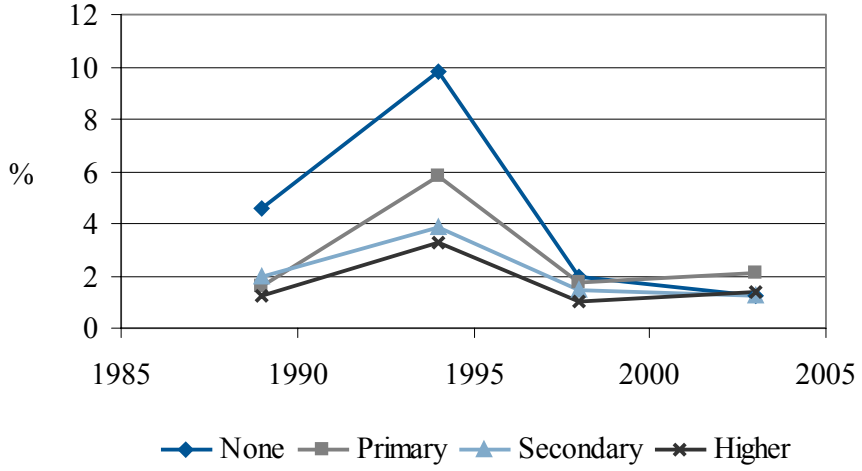
1.17 Bolivia: Prevalence of underweight by survey year and highest level of maternal education attained



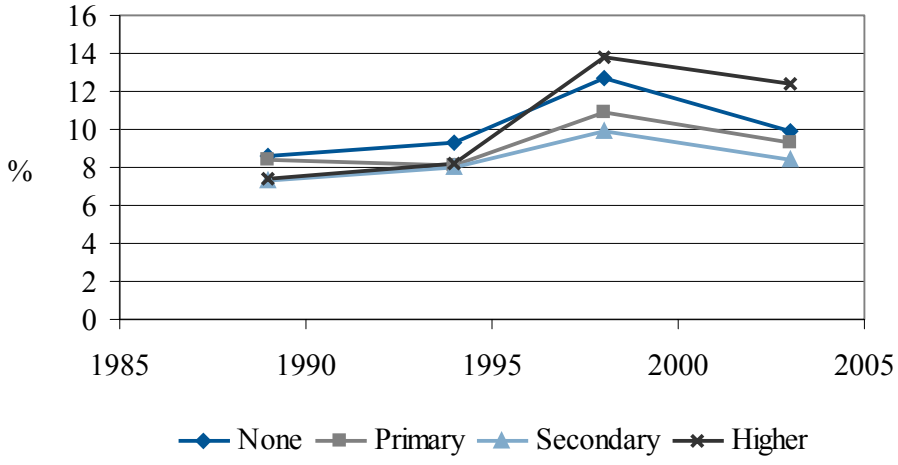
1.18 Bolivia: Prevalence of stunting by survey year and highest level of maternal education attained



1.19 Bolivia: Prevalence of wasting by survey year and highest level of maternal education attained



1.20 Bolivia: Prevalence of overweight by survey year and highest level of maternal education attained



Appendix 2

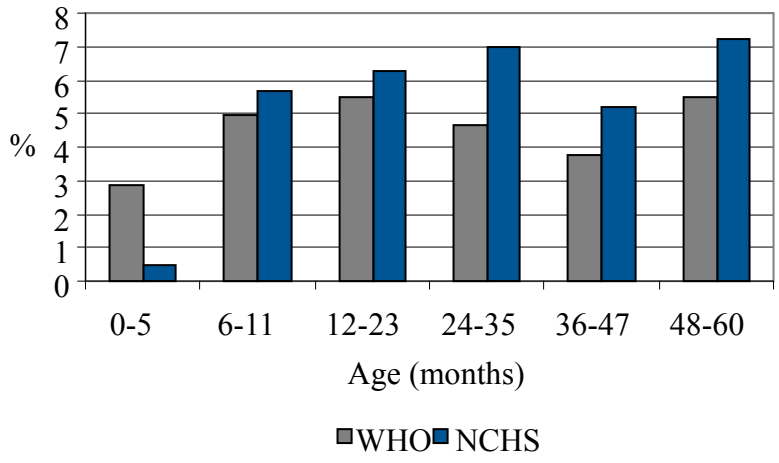
Brazil, 1996

Table 2.1: Anthropometric data by reference (WHO vs. NCHS), residence, infant sex, region, and age groups

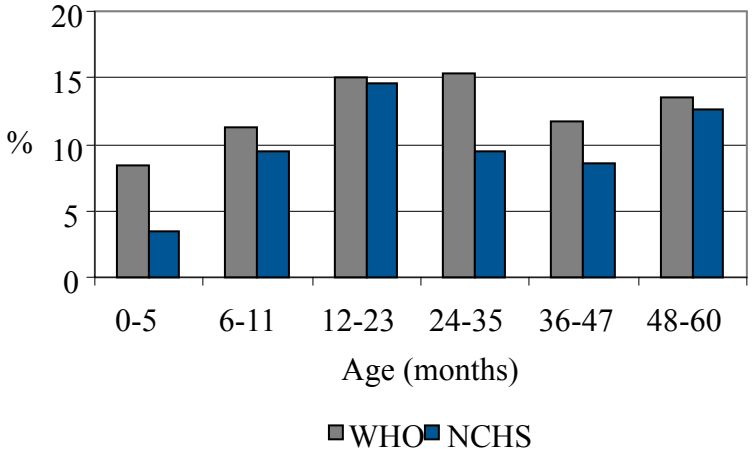
	Weight-for-age		Length/height-for-age		Weight-for-length/height			
	% <-3 SD	% < -2 SD	% < -3 SD	% < -2 SD	% < -3 SD	% < -2 SD	% >+2 SD	% >+3 SD
Reference								
WHO	1.05	4.68	3.93	13.10	0.98	2.90	6.16	1.52
NCHS	0.57	5.80	2.45	10.43	0.36	2.33	5.05	1.62
Residence								
Urban	0.81	3.96	2.73	10.04	0.93	2.66	1.52	1.52
Rural	1.78	6.89	7.73	22.84	1.12	3.64	6.05	1.51
Sex								
Male	1.00	4.91	4.77	14.92	0.92	3.14	6.92	1.70
Female	1.11	4.44	3.07	11.25	1.03	2.65	5.40	1.34
Region								
Rio de Janiero	1.40	3.72	2.83	4.72	2.38	4.29	6.19	0.95
Sao Paolo	0.76	3.82	1.89	7.03	0.55	2.19	5.74	2.73
Sul	0.21	1.85	1.73	6.36	0.26	0.56	6.56	0.89
Central Leste	0.50	4.21	1.10	8.56	0.53	1.74	7.36	1.47
Nordeste	1.95	7.09	7.33	21.68	1.34	4.11	6.36	1.25
Norte	0.79	6.26	5.93	21.08	0.62	2.99	6.22	2.02
Central Oeste	0.00	1.89	1.01	10.34	1.11	3.50	3.29	1.14
Age (WHO)								
0-5 mo	1.10	2.84	4.58	8.37	1.74	5.57	7.91	1.77
6-11 mo	1.40	4.96	2.89	11.21	2.57	4.38	9.06	2.56
12-23 mo	1.94	5.50	4.29	15.07	1.52	3.08	7.53	1.31
24-35 mo	0.66	4.65	5.12	15.32	0.80	2.60	4.62	1.04
36-47 mo	0.51	3.74	2.73	11.74	0.11	1.36	4.34	0.99
48-60 mo	0.87	5.49	3.80	13.53	0.25	2.48	5.73	2.05
Age (NCHS)								
0-5 mo	0.00	0.47	0.91	3.44	0.11	2.56	7.88	1.72
6-11 mo	0.96	5.66	1.98	9.54	1.04	3.67	7.71	2.95
12-23 mo	1.08	6.26	3.09	14.52	0.86	3.25	6.25	1.56
24-35 mo	0.58	6.98	2.57	9.48	0.13	2.17	2.70	0.45
36-47 mo	0.20	5.22	2.01	8.61	0.06	1.14	2.77	0.95
48-60 mo	0.45	7.22	3.04	12.60	0.12	1.95	5.70	2.73

Figures 2.1-2.4: Comparison of the prevalence of underweight, stunting, wasting and overweight using the WHO Standard vs. the NCHS reference, overall and by age group

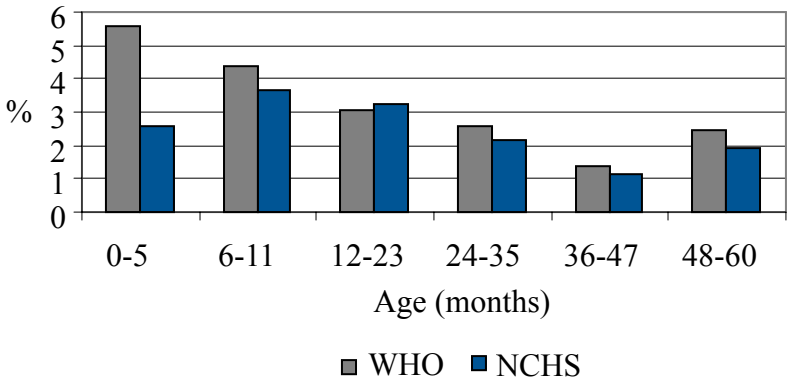
2.1 Brazil, 1996: Comparison of prevalence of underweight using the WHO standard vs. NCHS reference



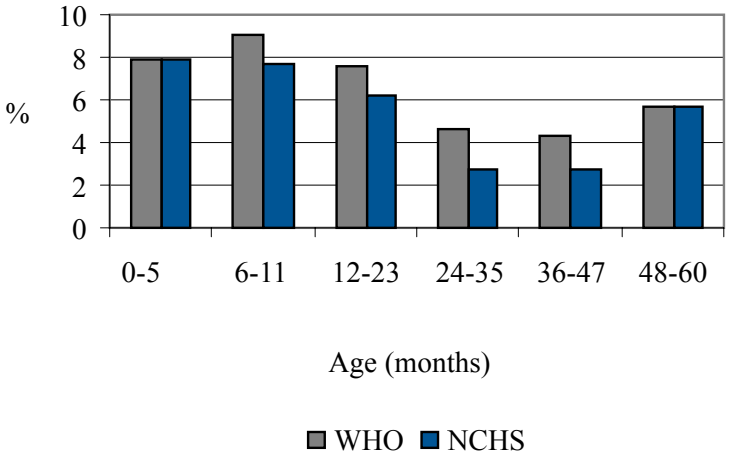
2.2 Brazil, 1996: Comparison of prevalence of stunting using the WHO Standard vs. NCHS reference



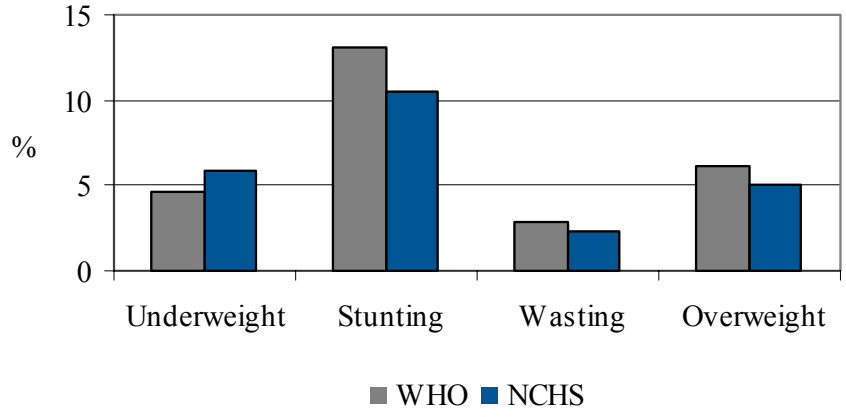
2.3 Brazil, 1996: Comparison of prevalence of wasting using the WHO Standard vs. NCHS reference



2.4 Brazil, 1996: Comparison of prevalence of overweight using the WHO Standard vs. NCHS reference

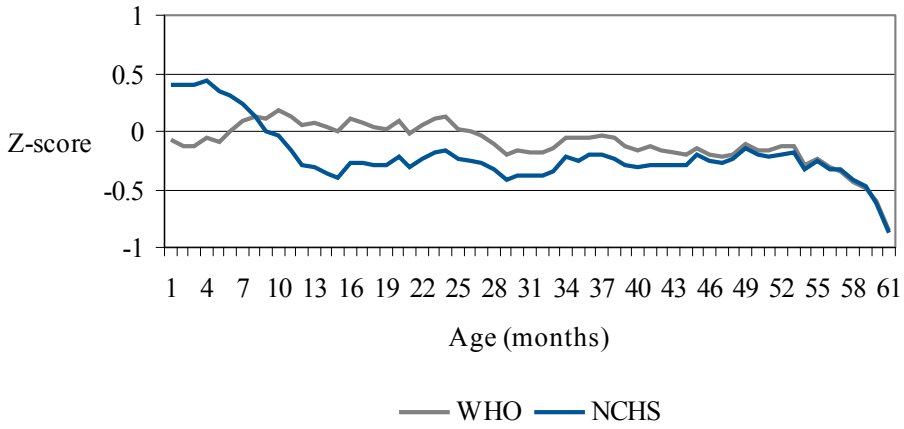


2.5 Brazil, 1996: Comparison of the prevalence of underweight, stunting, wasting and overweight using the WHO Standard vs. NCHS reference

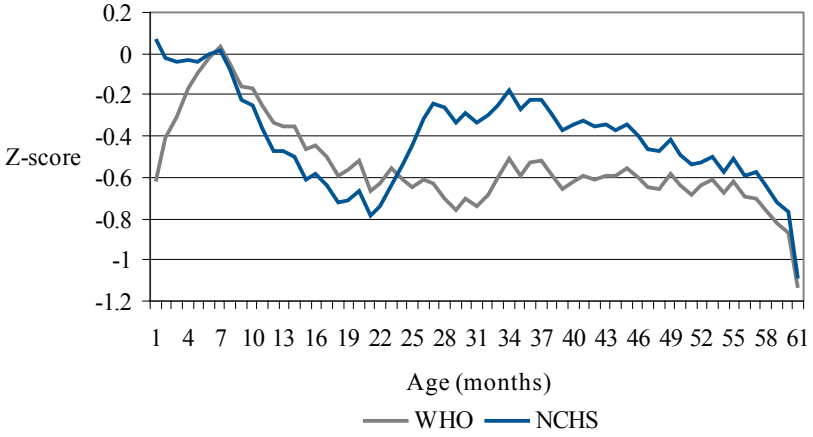


Figures 2.6-2.8: Comparison of five-month moving average Z-scores at each age using the WHO Standard vs. the NCHS reference

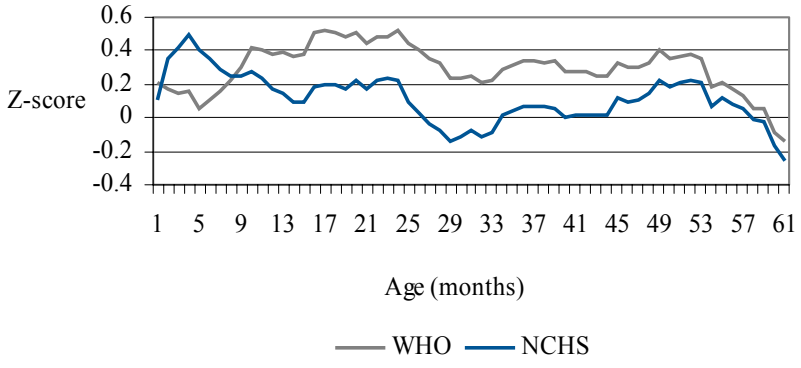
2.6 Brazil, 1996: Moving average weight-for-age Z-score using the WHO Standard vs. NCHS reference



2.7 Brazil, 1996: Moving average length/height-for-age Z-score using the WHO Standard vs. NCHS reference

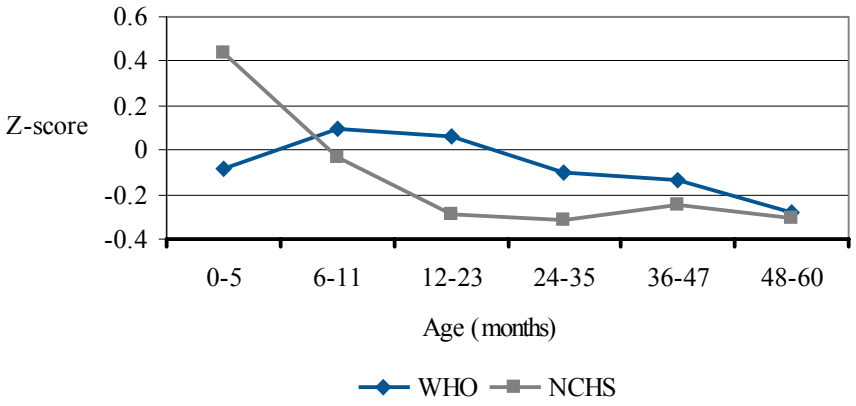


2.8 Brazil, 1996: Moving average weight-for-length/height Z-score using the WHO Standard vs. NCHS reference

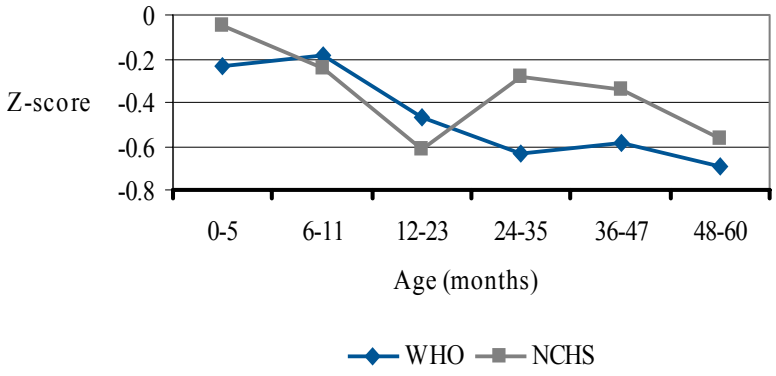


Figures 2.9-2.11: Comparison of mean Z-scores by age group using the WHO Standard vs. the NCHS reference

2.9 Brazil, 1996: Comparison of mean weight-for-age Z-score by age group using the WHO Standard vs. NCHS reference



2.10 Brazil, 1996: Comparison of mean length/height-for-age Z-score by age group using the WHO Standard vs. NCHS reference



2.11 Brazil, 1996: Comparison of mean weight-for-length/height Z-score by age group using the WHO Standard vs. NCHS reference

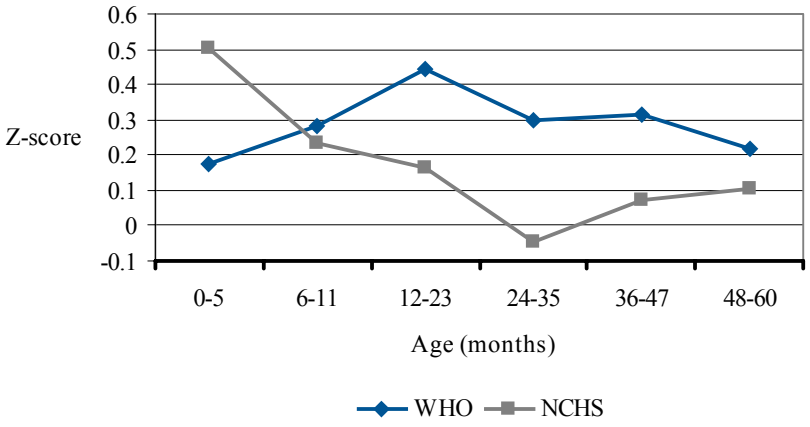


Figure 2.12: Five-month moving average for all anthropometric indicators using the WHO Standard, Brazil, 1996.

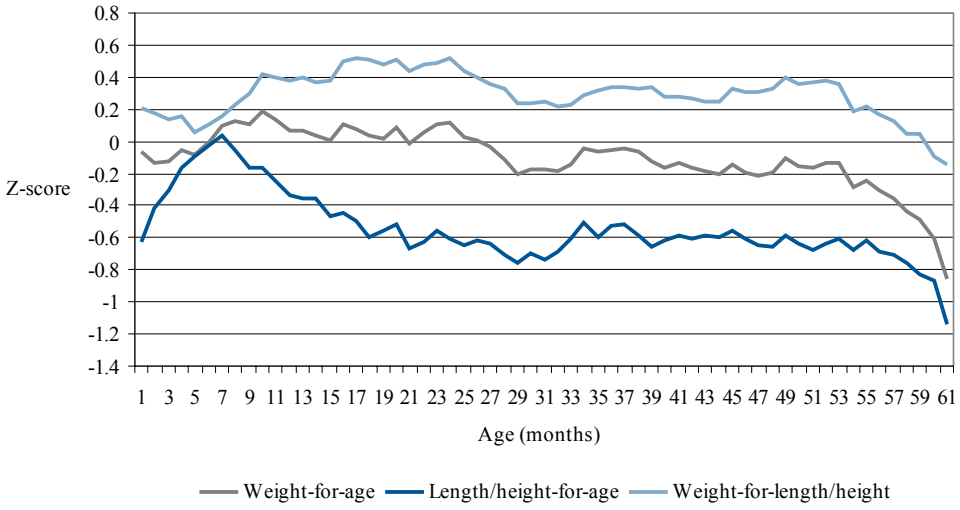
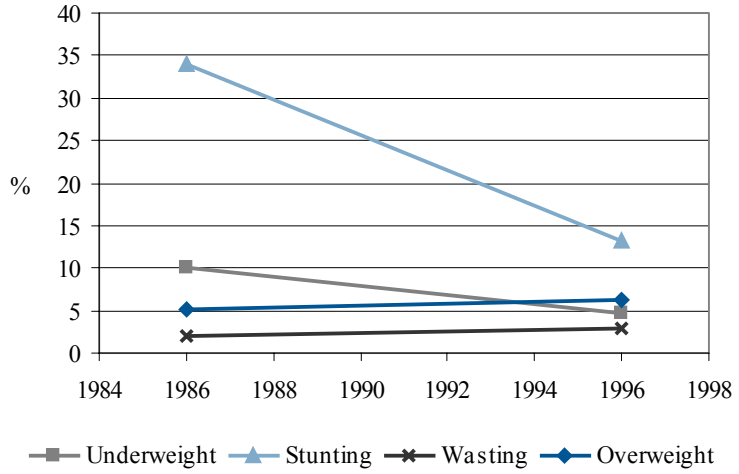
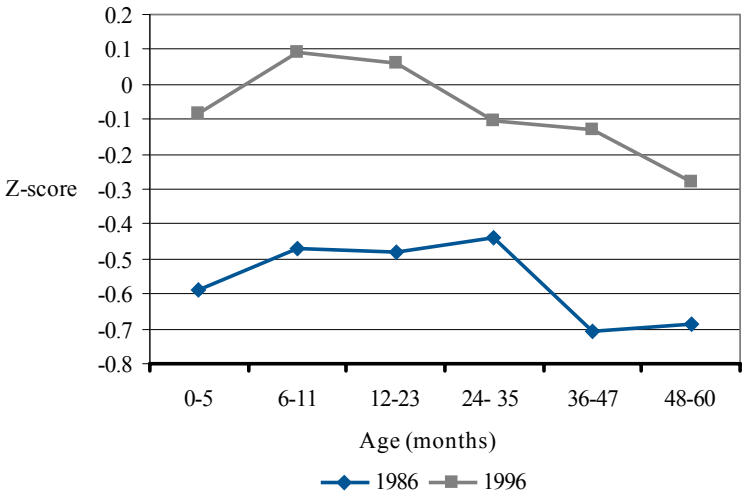


Figure 2.13: Trends in prevalence of all anthropometric indicators for children under five, 1986-1996

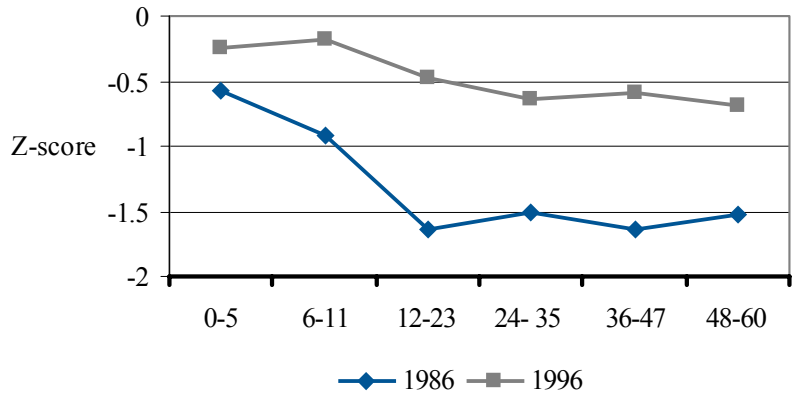


Figures 2.14-2.16: Trends in mean Z-scores by age groups, 1986-1996

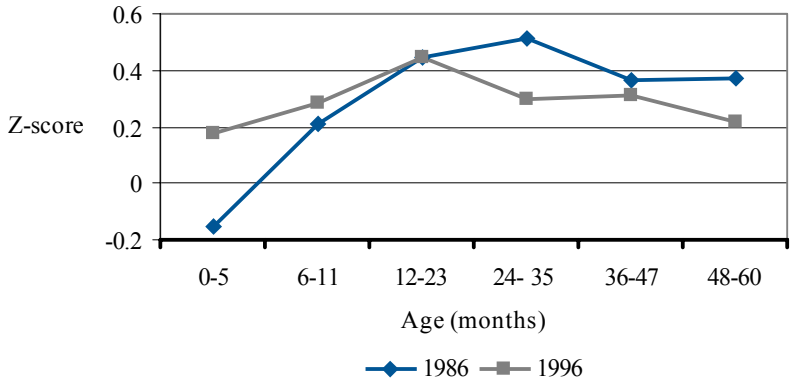
2.14 Brazil: Trends in mean weight-for-age Z-score by age group and survey year



2.15 Brazil: Trends in the mean length/height-for-age Z-score by age group and survey year

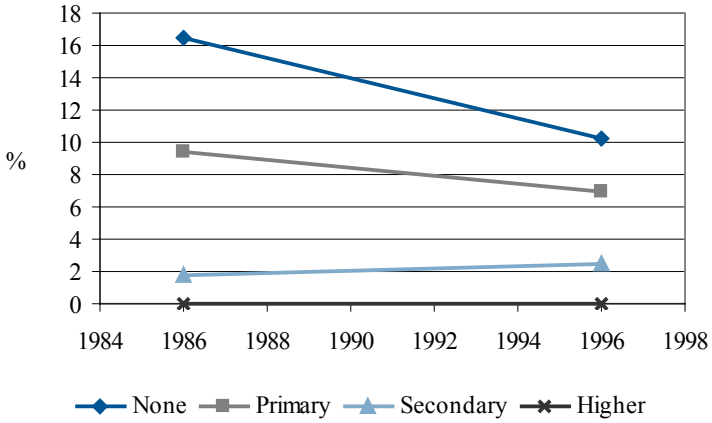


2.16 Brazil: Trends in the mean weight-for-length/height Z-score by age group and survey year

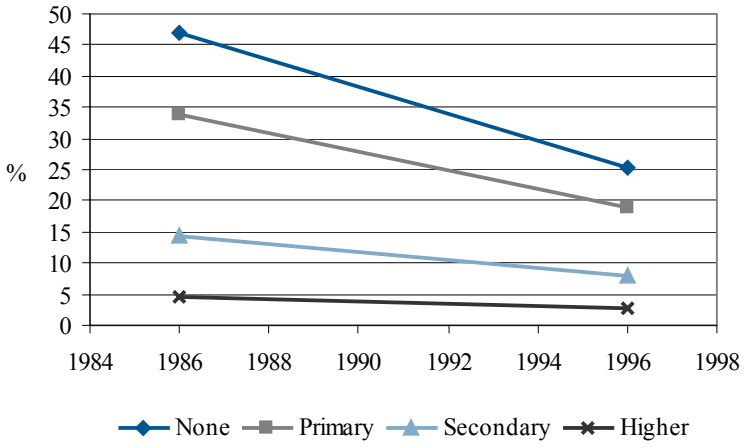


Figures 2.17-2.20: Trends in the prevalence of all anthropometric indicators by highest level of maternal education attained, 1986-1996

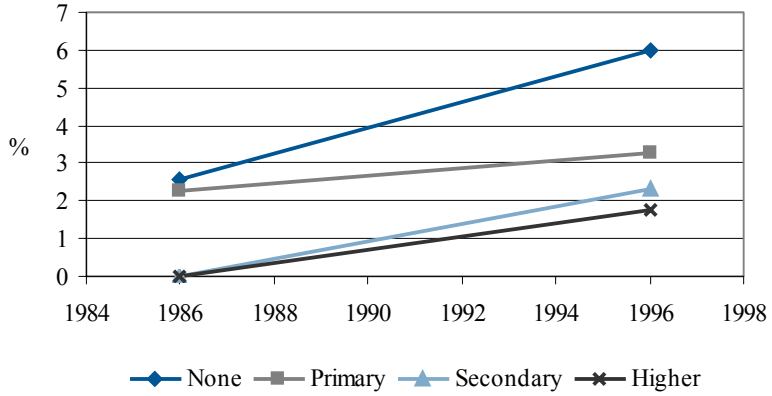
2.17 Brazil: Prevalence of underweight by survey year and highest level of maternal education attained



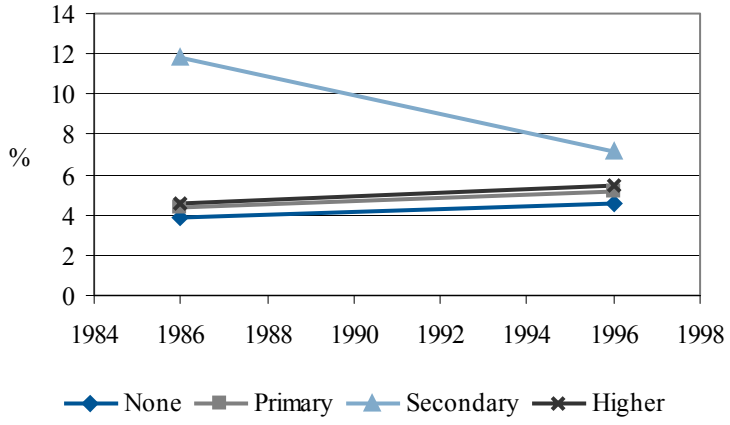
2.18 Brazil: Prevalence of stunting by survey year and highest level of maternal education attained



2.19 Brazil: Prevalence of wasting by survey year and highest level of maternal education attained



2.20 Brazil: Prevalence of overweight by survey year and highest level of maternal education attained



Appendix 3

Colombia, 2005

Table 3.1: Anthropometric data by reference (WHO vs. NCHS), residence, infant sex, region, and age groups

	Weight-for-age		Length/height-for-age		Weight-for-length/height			
	% <-3 SD	% < -2 SD	% < -3 SD	% <-2 SD	% < -3 SD	% < -2 SD	% >+2 SD	% >+3 SD
Reference								
WHO	0.85	5.15	3.45	16.26	0.43	1.65	4.26	0.87
NCHS	0.62	7.05	2.15	12.26	0.10	1.27	3.15	0.79
Residence								
Urban	0.63	4.15	2.21	12.96	0.47	1.59	4.85	0.95
Rural	1.29	7.19	5.97	22.96	0.34	1.78	3.06	0.69
Sex								
Male	0.86	5.55	3.99	17.79	v	1.76	4.33	0.95
Female	0.85	4.75	2.91	14.71	0.42	1.54	4.19	0.78
Region (Department)								
Antioquia	0.69	4.36	2.65	16.37	0.10	0.68	4.82	0.93
Atlántico	1.43	5.90	2.11	13.21	0.77	2.14	4.08	0.81
Bogotá	0.66	4.19	3.23	16.94	0.12	0.56	5.41	1.00
Bolívar	0.80	7.07	4.93	18.03	0.00	1.48	2.64	0.63
Boyacá	2.48	8.38	7.19	30.05	1.63	2.30	6.14	1.47
Caldas	0.00	2.33	2.78	13.03	0.00	1.55	7.44	0.41
Caquetá	1.32	6.07	3.79	14.49	0.50	3.59	2.51	0.41
Cauca	1.84	6.87	6.19	20.95	0.91	4.03	4.81	0.75
Cesar	0.94	5.97	3.86	15.16	0.18	1.38	1.47	0.13
Córdoba	1.03	7.93	4.19	22.28	0.14	0.79	2.97	0.25
Cundinamarca	0.00	2.35	2.41	13.57	0.00	0.56	4.03	0.45
Chocó	0.54	4.76	2.55	14.97	0.44	1.65	4.40	0.97
Huila	0.49	5.58	3.71	15.66	0.00	2.63	1.54	0.22
La Guajira	2.81	13.36	12.61	29.24	0.97	2.59	2.71	0.00
Magdalena	1.13	6.99	6.33	21.09	0.34	2.33	4.00	0.57
Meta	0.85	3.55	2.77	11.07	0.00	1.57	5.22	1.01
Nariño	1.06	4.27	5.56	26.35	0.24	1.18	4.84	0.24
Norte de Santander	0.00	1.37	2.29	12.57	0.57	0.57	2.84	0.34
Quindío	0.34	3.11	0.75	10.11	0.67	2.05	4.50	0.69
Risaralda	0.77	3.90	1.97	9.27	0.00	1.13	5.39	2.03
Santander	0.31	3.61	1.62	11.23	0.89	2.33	5.02	2.58
Sucre	0.92	7.83	3.31	16.99	0.18	2.08	2.49	0.38
Tolima	1.53	7.42	3.62	14.47	1.01	3.08	5.96	1.84
Valle	0.64	4.94	1.26	9.89	1.04	2.88	3.67	1.15
Arauca	1.27	6.10	2.66	14.88	0.00	1.87	1.59	0.34
Casanare	0.00	3.63	0.65	7.10	1.55	1.78	3.92	2.66
Putumayo	0.00	1.45	3.03	11.69	1.64	4.00	3.70	0.42

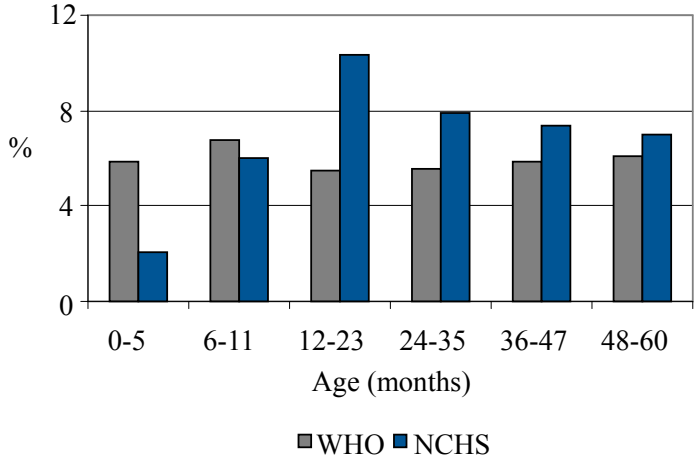
Continue >

Continue Table 3.1: Anthropometric data by reference (WHO vs. NCHS), residence, infant sex, region, and age groups

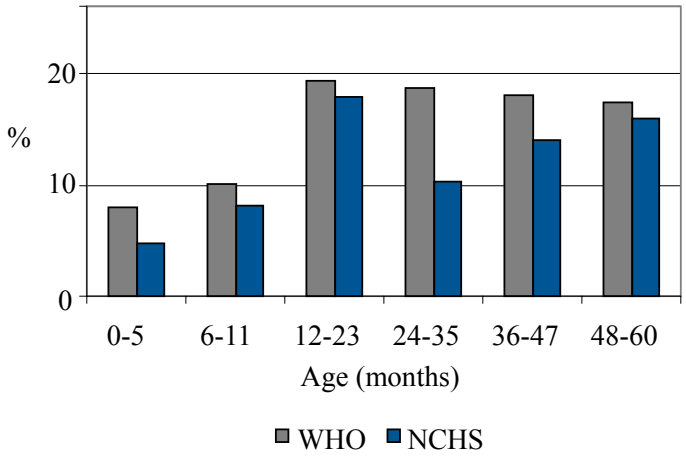
	Weight-for-age		Length/height-for-age		Weight-for-length/height			
	% <-3 SD	% < -2 SD	% < -3 SD	% <-2 SD	% < -3 SD	% < -2 SD	% >+2 SD	% >+3 SD
San Andrés y Providen.	0.72	5.12	1.43	5.34	1.30	2.04	9.81	1.96
Amazonas	1.10	7.00	5.78	16.61	0.24	2.51	4.21	0.30
Guainía	1.45	5.23	2.22	10.60	1.20	4.64	4.43	1.59
Guaviare	0.28	4.61	1.03	9.25	0.58	2.48	4.46	1.53
Vaupés	0.70	8.66	2.87	16.26	0.41	3.67	2.43	0.34
Vichada	1.35	6.37	2.32	12.31	0.52	1.82	2.81	0.46
Age (WHO)								
0-5 mo	1.63	5.14	1.65	7.41	1.79	5.09	6.32	1.73
6-11 mo	1.52	6.33	3.03	10.03	0.48	2.29	5.64	0.81
12-23 mo	0.68	4.67	5.12	19.29	0.40	1.30	3.83	0.36
24-35 mo	0.75	4.74	3.81	18.34	0.12	1.33	4.83	1.15
36-47 mo	0.63	5.15	3.21	17.66	0.20	1.02	4.13	0.95
48-60 mo	0.70	5.45	2.73	16.66	0.36	1.18	2.81	0.68
Age (NCHS)								
0-5 mo	0.22	1.43	0.58	3.27	0.09	2.01	6.43	1.92
6-11 mo	0.93	5.39	1.61	7.61	0.00	1.10	5.22	0.87
12-23 mo	0.93	9.82	3.39	17.44	0.24	2.02	2.56	0.18
24-35 mo	0.75	7.83	1.77	10.17	0.05	1.16	2.47	1.03
36-47 mo	0.49	7.19	2.11	12.44	0.08	0.75	2.68	0.72
48-60 mo	0.36	6.66	2.24	14.88	0.06	0.93	2.48	0.70

Figures 3.1-3.4: Comparison of the prevalence of underweight, stunting, wasting and overweight using the WHO Standard vs. the NCHS reference, overall and by age group

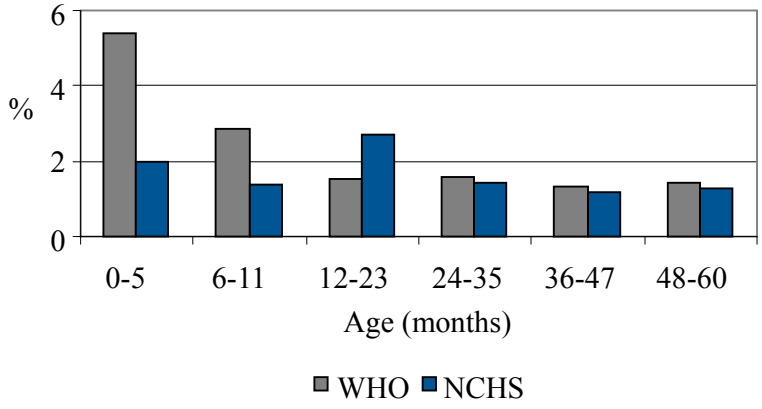
3.1 Colombia, 2005: Comparison of prevalence of underweight using the WHO standard vs. NCHS reference



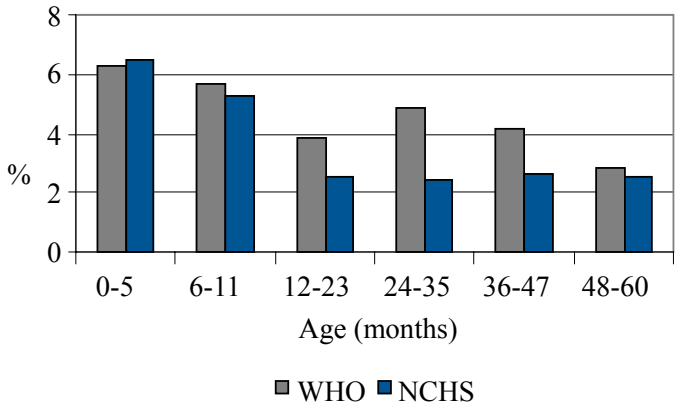
3.2 Colombia, 2005: Comparison of prevalence of stunting using the WHO Standard vs. NCHS reference



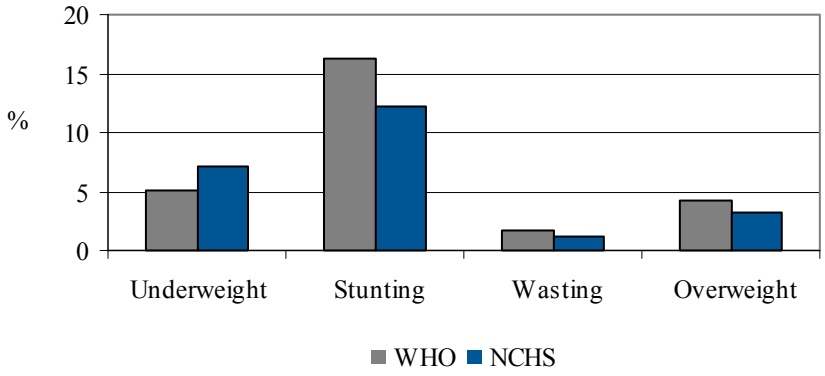
3.3 Colombia, 2005: Comparison of prevalence of wasting using the WHO Standard vs. NCHS reference



3.4 Colombia, 2005: Comparison of prevalence of overweight using the WHO Standard vs. NCHS reference

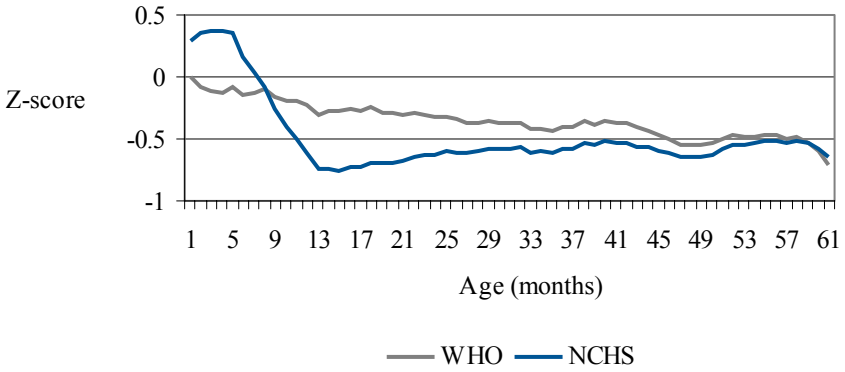


3.5 Colombia, 2005: Comparison of the prevalence of underweight, stunting, wasting and overweight using the WHO Standard vs. NCHS reference

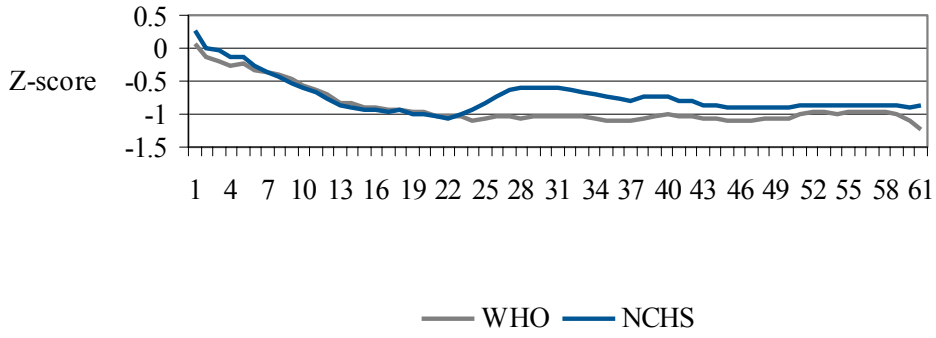


Figures 3.6-3.8: Comparison of five-month moving average Z-scores at each age using the WHO Standard vs. the NCHS reference

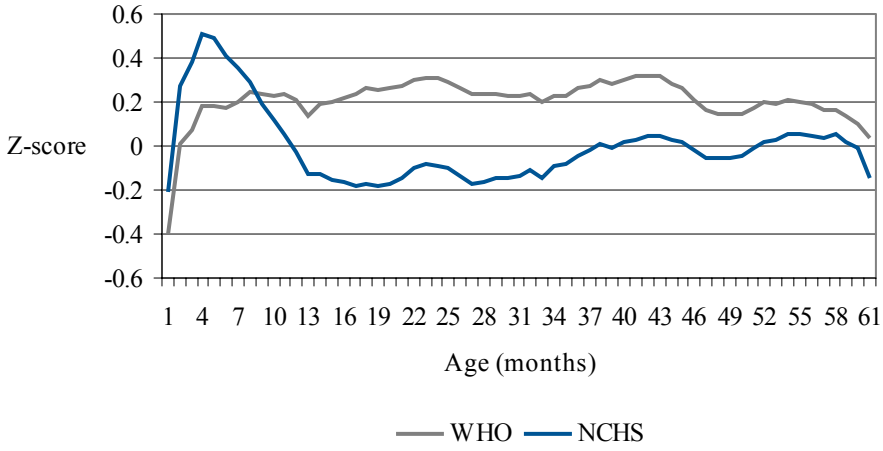
3.6 Colombia, 2005: Moving average weight-for-age Z-score using the WHO Standard vs. NCHS reference



3.7 Colombia, 2005: Moving average length/height-for-age Z-score using the WHO Standard vs. NCHS reference

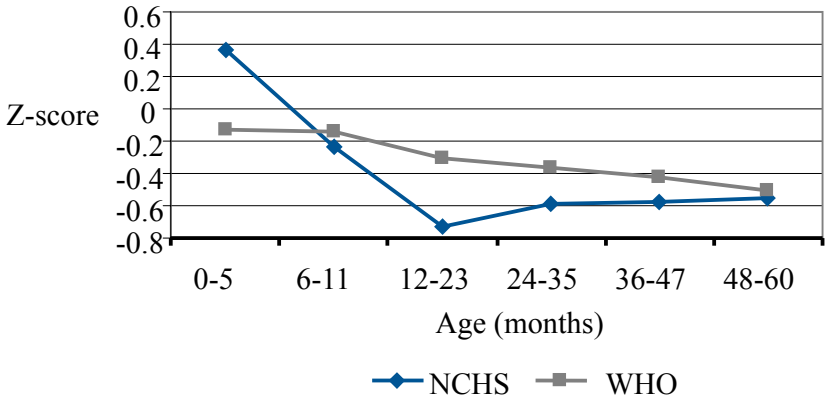


3.8 Colombia, 2005: Moving average weight-for-length/height Z-score using the WHO Standard vs. NCHS reference

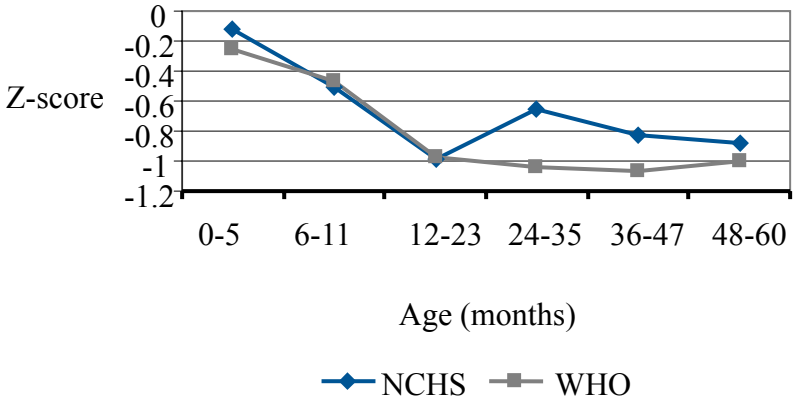


Figures 3.9-3.11: Comparison of mean Z-scores by age group using the WHO Standard vs. the NCHS reference

3.9 Colombia, 2005: Comparison of mean weight-for-age Z-score by age group using the WHO Standard vs. NCHS reference



3.10 Colombia, 2005: Comparison of mean length/height-for-age Z-score by age group using the WHO Standard vs. NCHS reference



3.11 Colombia, 2005: Comparison of mean weight-for-length/height Z-score by age group using the WHO Standard vs. NCHS reference

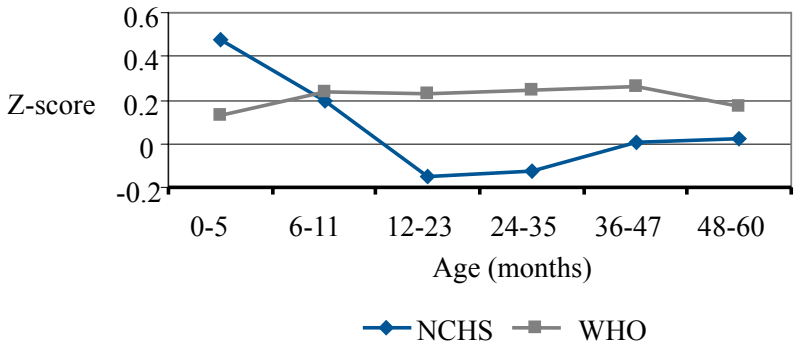


Figure 3.12: Five-month moving average for all anthropometric indicators using the WHO Standard, Colombia 2005.

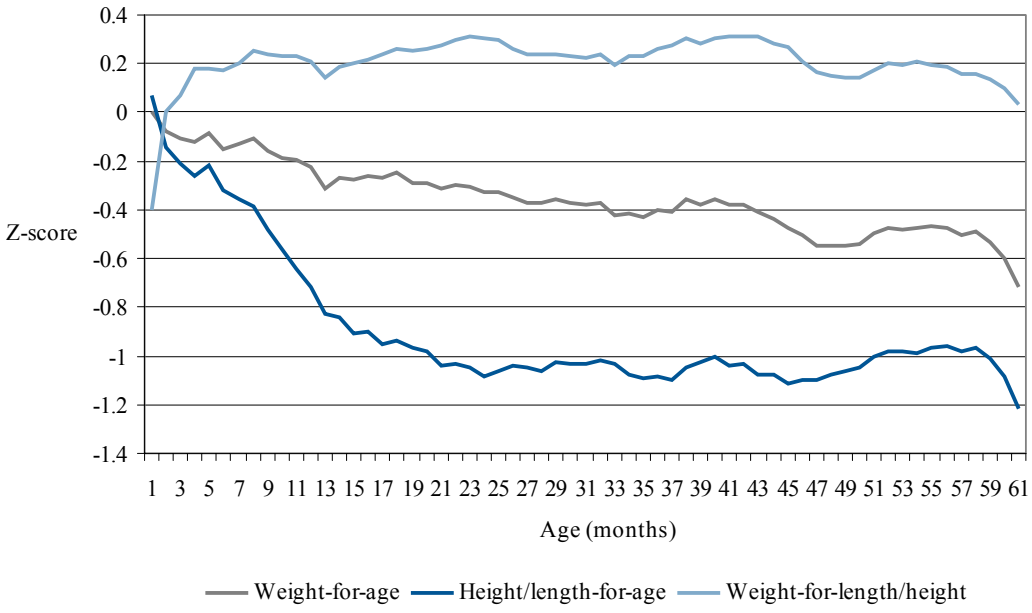
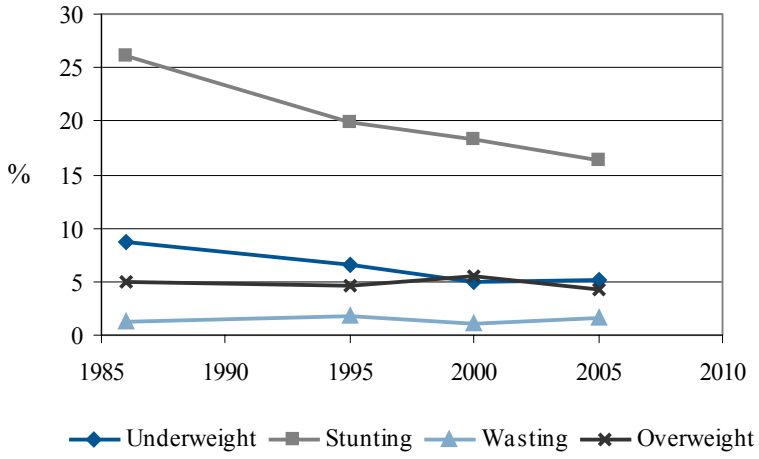
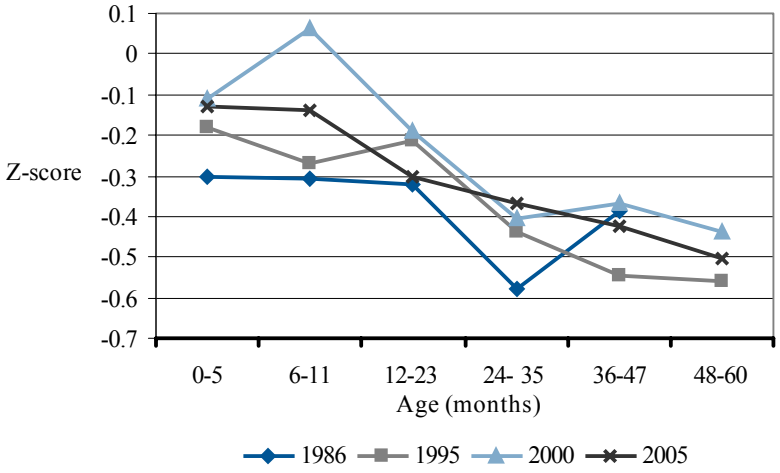


Figure 3.13: Trends in prevalence of all anthropometric indicators for children under five, 1986-2005

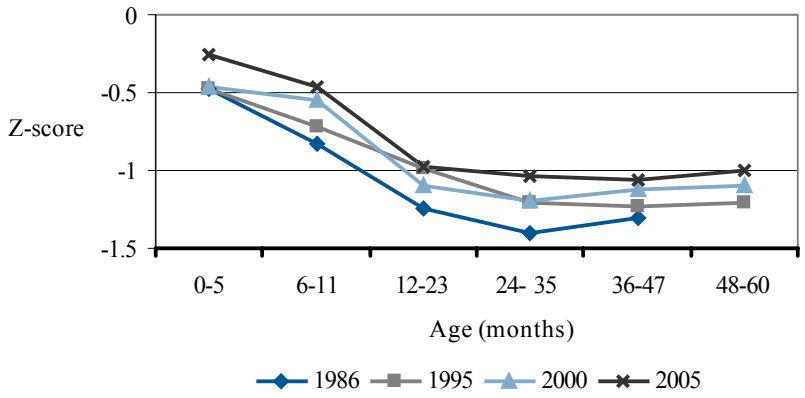


Figures 3.14-3.16: Trends in mean Z-scores by age groups, 1986-2005

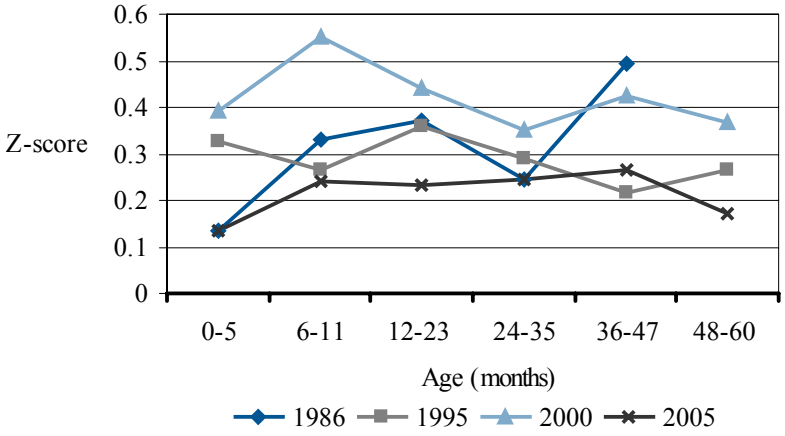
3.14 Colombia: Trends in mean weight-for-age Z-score by age group and survey year



3.15 Colombia: Trends in the mean length/height-for-age Z-score by age group and survey year

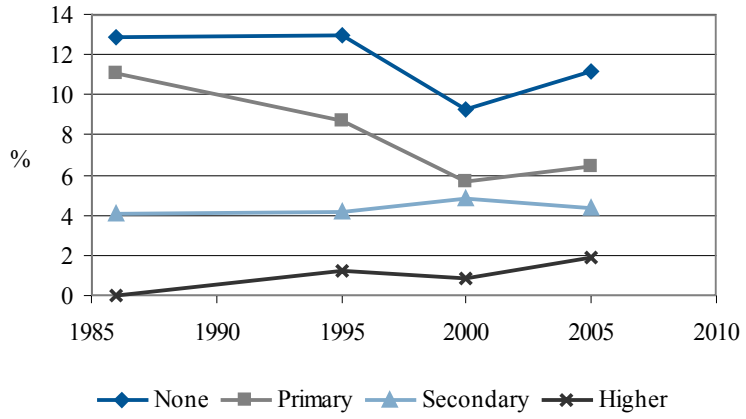


3.16 Colombia: Trends in the mean weight-for-length/height Z-score by age group and survey year

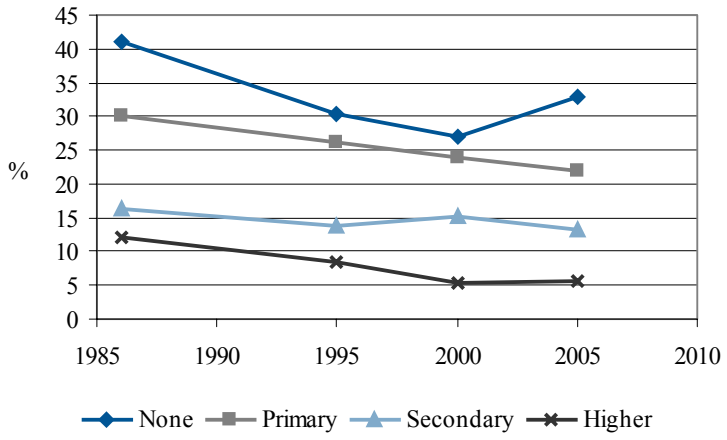


Figures 3.17-3.20: Trends in the prevalence of all anthropometric indicators by highest level of maternal education attained, 1986-2005

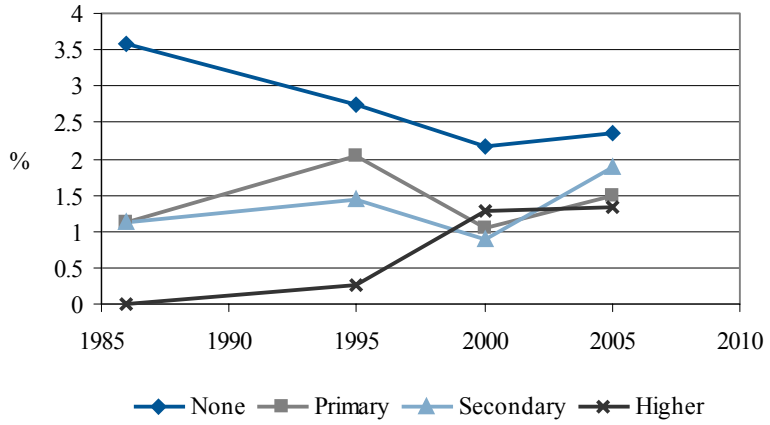
3.17 Colombia: Prevalence of underweight by survey year and highest level of maternal education attained



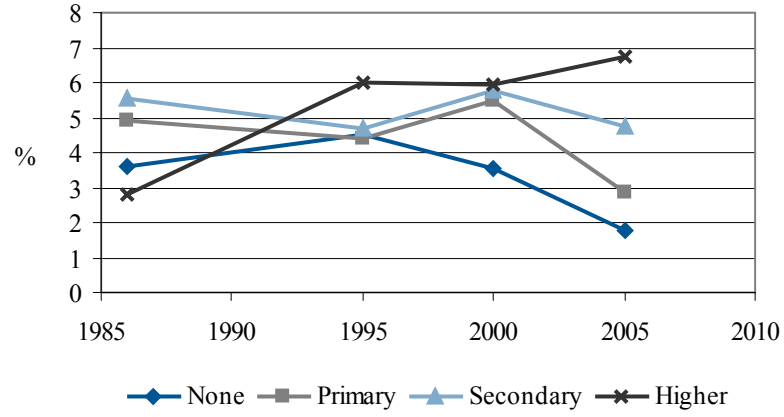
3.18 Colombia: Prevalence of stunting by survey year and highest level of maternal education attained



3.19 Colombia: Prevalence of wasting by survey year and highest level of maternal education attained



3.20 Colombia: Prevalence of overweight by survey year and highest level of maternal education attained



Appendix 4

Dominican Republic, 2002

Table 4.1: Anthropometric data by reference (WHO vs. NCHS), residence, infant sex, region, and age groups

	Weight-for-age		Length/height-for-age		Weight-for-length/height			
	% <-3 SD	% < -2 SD	% < -3 SD	% <-2 SD	% < -3 SD	% < -2 SD	+>2 SD	% >+3 SD
Reference								
WHO	0.83	4.28	3.87	11.79	0.77	2.27	8.72	2.31
NCHS	0.52	5.29	2.40	9.00	0.22	1.79	6.57	2.15
Residence								
Urban	0.61	3.58	3.52	10.60	0.68	1.91	9.38	2.39
Rural	1.22	5.52	4.48	13.88	0.93	2.89	7.56	2.18
Sex								
Male	1.07	4.64	4.58	13.32	0.97	2.54	9.22	2.25
Female	0.59	3.91	3.15	10.22	0.57	1.99	8.21	2.38
Region								
Distrito Nacional	1.65	3.63	4.35	10.37	1.01	2.35	11.41	2.68
Santo Domingo	0.59	3.35	4.54	11.83	0.60	1.79	10.71	3.17
Monte Plata	1.08	6.20	5.77	17.31	2.98	7.32	8.67	2.44
Azua	0.72	6.21	2.15	13.37	0.48	1.20	6.02	0.96
Peravia	0.29	4.09	2.96	11.83	0.59	1.17	5.57	1.47
San Cristobal	1.82	6.75	5.50	13.95	1.48	3.33	9.61	2.96
San Jose de Ocoa	0.38	4.18	3.44	11.45	0.00	2.29	6.87	2.29
Espaillat	1.72	4.14	4.17	11.11	1.38	5.19	9.00	3.11
Puerto Plata	0.96	4.81	4.55	12.99	2.27	3.90	9.74	2.60
Santiago	0.19	3.28	3.68	9.86	0.19	1.36	9.73	2.92
Duarte	0.27	2.72	1.90	7.34	1.63	2.18	8.99	2.45
Maria Trinidad Sanchez	0.00	2.76	1.38	11.03	0.00	1.72	6.55	1.72
Salcedo	0.33	2.31	1.64	8.22	0.00	1.98	7.92	1.98
Samana	1.31	4.92	1.97	9.54	1.32	2.64	5.61	1.98
Bahoruco	1.17	8.22	6.84	20.52	0.94	1.65	4.24	1.41
Barahona	1.52	7.32	4.08	13.78	0.25	3.05	4.06	1.02
Independencia	1.51	5.74	3.95	17.02	0.61	2.13	4.26	0.61
Pedernales	0.56	5.59	3.37	18.26	0.56	1.40	5.34	0.84
El Seybo	0.87	4.07	2.64	9.97	0.29	3.21	4.96	0.87
Hato Mayor	1.05	5.94	2.81	12.63	0.35	1.06	4.95	1.06
La Altagracia	1.58	4.75	4.10	8.20	0.96	4.14	4.78	1.27
La Romana	0.95	4.28	4.31	12.44	0.24	1.19	7.64	2.39
San Pedro de Macoris	1.11	4.71	2.24	11.76	0.84	2.79	9.78	2.51
Elias Pina	0.57	5.93	5.67	18.98	0.85	1.69	3.11	0.28
San Juan	0.57	3.72	2.57	12.29	0.29	1.15	8.33	1.44
Dajabon	0.34	4.38	1.02	10.51	0.68	1.69	6.78	0.00
Monte Cristi	0.00	2.42	2.04	9.80	1.22	2.85	8.13	3.25
Santiago Rodriguez	0.50	3.00	3.50	11.00	0.50	0.50	6.03	0.00

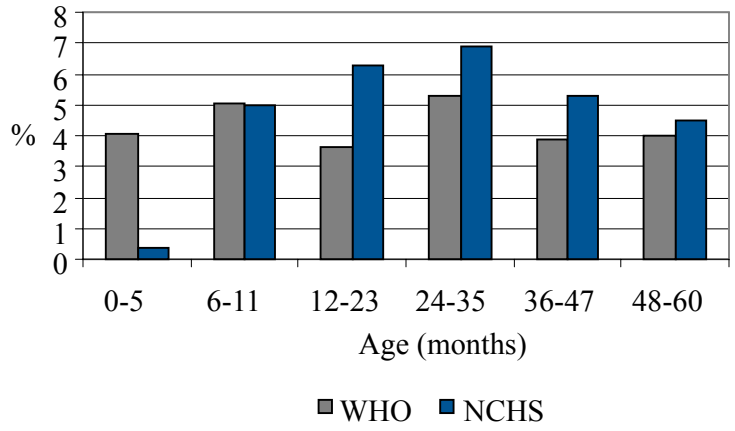
Continue >

Continue **Table 4.1**: Anthropometric data by reference (WHO vs. NCHS), residence, infant sex, region, and age groups

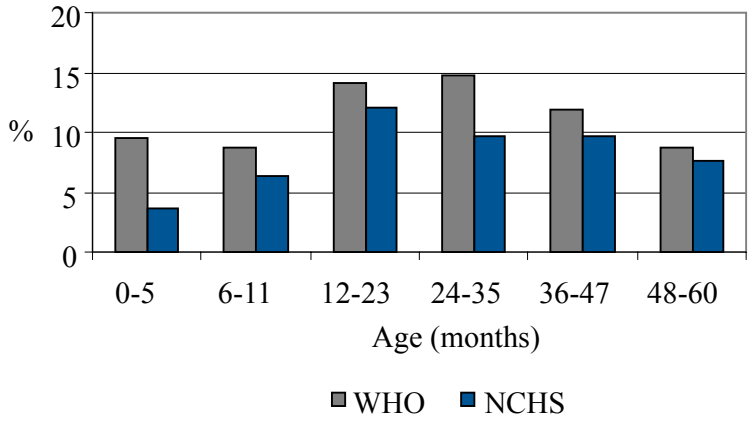
	Weight-for-age		Length/height-for-age		Weight-for-length/height			
	% <-3 SD	% < -2 SD	% < -3 SD	% <-2 SD	% < -3 SD	% < -2 SD	+>2 SD	% >+3 SD
Valverde	0.70	2.45	3.50	10.14	0.00	1.06	5.99	1.06
La Vega	0.76	5.06	4.06	13.71	0.25	1.27	10.15	2.03
Monsenol Nouel	0.27	3.81	3.83	11.20	0.55	1.65	5.49	0.55
Sanchez Ramirez	0.34	4.41	2.37	9.15	0.34	2.03	7.12	0.68
Age (WHO)								
0-5 mo	0.51	4.05	3.60	9.48	3.14	6.48	12.65	3.62
6-11 mo	0.93	5.03	3.25	8.69	1.06	3.32	7.13	1.19
12-23 mo	0.92	3.62	4.16	14.11	0.86	2.16	8.26	1.97
24-35 mo	1.18	5.30	4.89	14.69	0.48	1.67	8.02	1.36
36-47 mo	0.80	3.89	4.39	11.89	0.36	1.54	9.27	3.44
48-60 mo	0.51	4.01	2.46	8.77	0.43	1.74	8.67	2.58
Age (NCHS)								
0-5 mo	0.03	0.37	0.14	3.71	0.67	2.85	11.65	2.62
6-11 mo	0.26	4.99	1.39	6.40	0.32	2.37	6.16	1.58
12-23 mo	0.79	6.30	2.78	12.03	0.25	2.29	5.97	2.05
24-35 mo	0.88	6.91	3.04	9.72	0.20	1.59	3.32	0.87
36-47 mo	0.55	5.30	2.98	9.71	0.12	1.50	7.10	2.47
48-60 mo	0.14	4.48	2.04	7.67	0.12	1.19	8.41	3.33

Figures 4.1-4.4: Comparison of the prevalence of underweight, stunting, wasting and overweight using the WHO Standard vs. the NCHS reference, overall and by age group

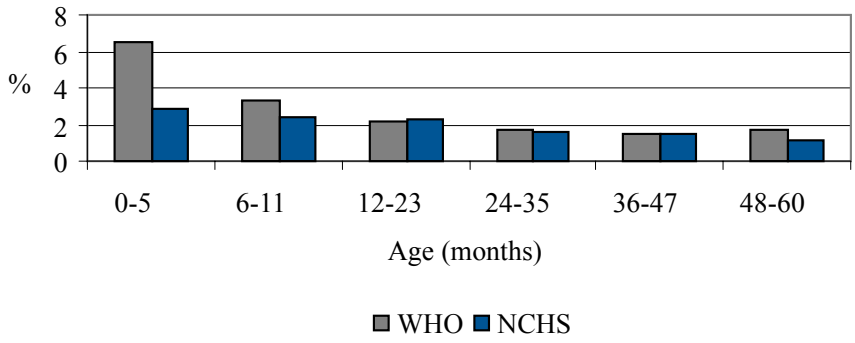
4.1 Dominican Republic, 2002: Comparison of prevalence of underweight using the WHO standard vs. NCHS reference



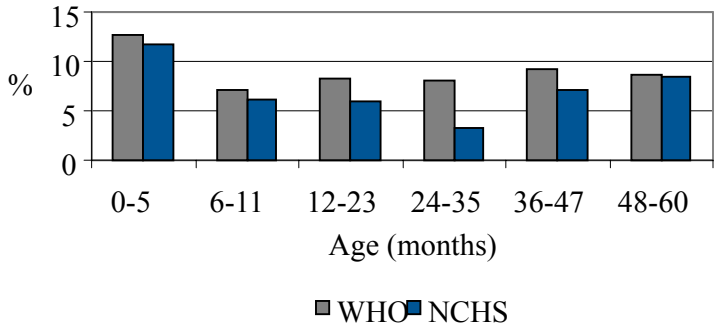
4.2 Dominican Republic, 2002: Comparison of prevalence of stunting using the WHO Standard vs. NCHS reference



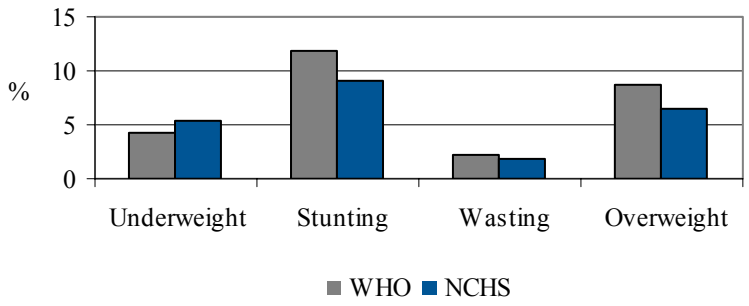
4.3 Dominican Republic, 2002: Comparison of prevalence of wasting using the WHO Standard vs. NCHS reference



4.4 Dominican Republic, 2002: Comparison of prevalence of overweight using the WHO Standard vs. NCHS reference

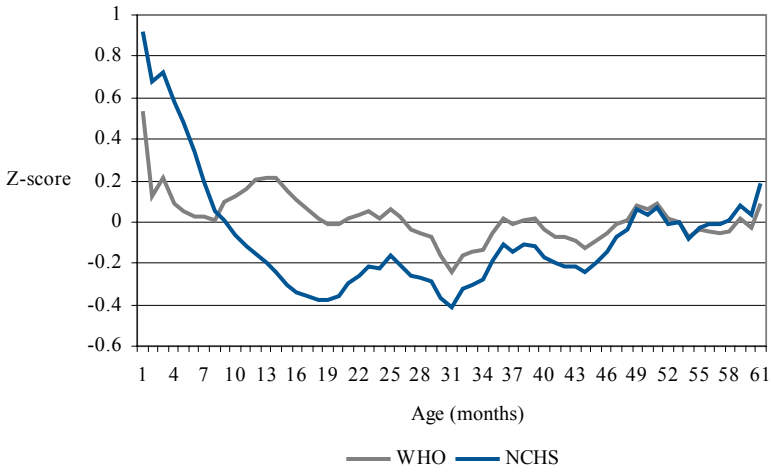


4.5 Dominican Republic, 2002: Comparison of the prevalence of underweight, stunting, wasting and overweight using the WHO Standard vs. NCHS reference

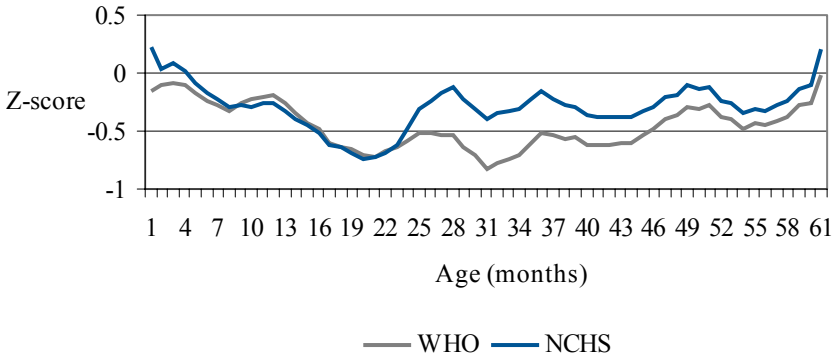


Figures 4.6-4.8: Comparison of five-month moving average Z-scores at each age using the WHO Standard vs. the NCHS reference

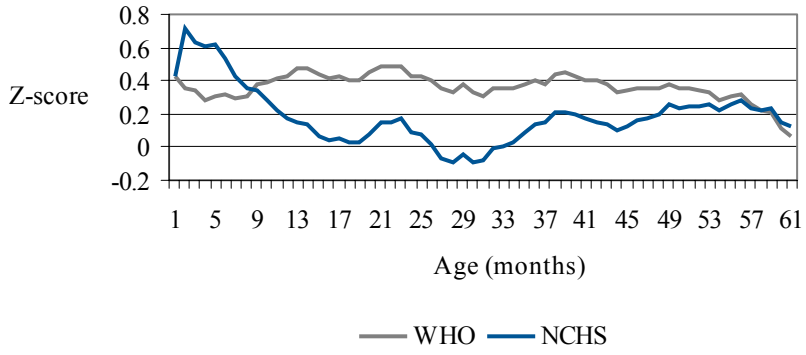
4.6 Dominican Republic, 2002: Moving average weight-for-age Z-score using the WHO Standard vs. NCHS reference



4.7 Dominican Republic, 2002: Moving average length/height-for-age Z-score using the WHO Standard vs. NCHS reference

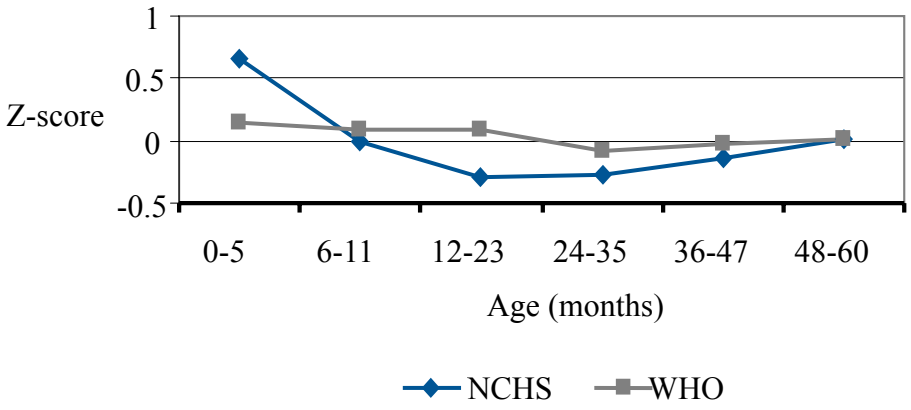


4.8 Dominican Republic, 2002: Moving average weight-for-length/height Z-score using the WHO Standard vs. NCHS reference

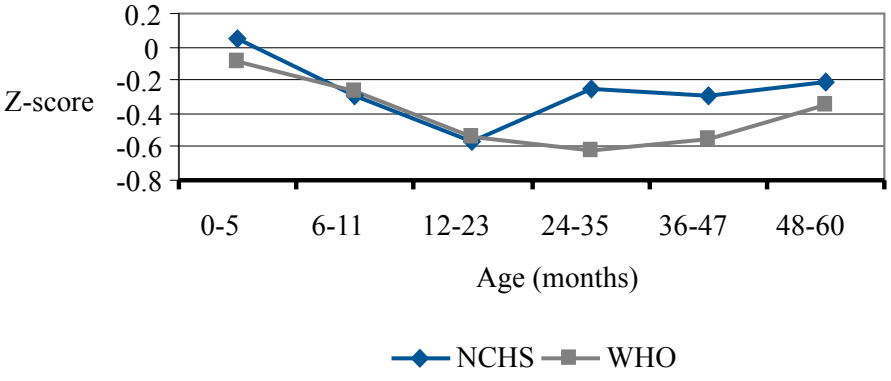


Figures 4.9-4.11: Comparison of mean Z-scores by age group using the WHO Standard vs. the NCHS reference

4.9 Dominican Republic, 2002: Comparison of mean weight-for-age Z-score by age group using the WHO Standard vs. NCHS reference



4.10 Dominican Republic, 2002: Comparison of mean length/height-for-age Z-score by age group using the WHO Standard vs. NCHS reference



4.11 Dominican Republic, 2002: Comparison of mean weight-for-length/height Z-score by age group using the WHO Standard vs. NCHS reference

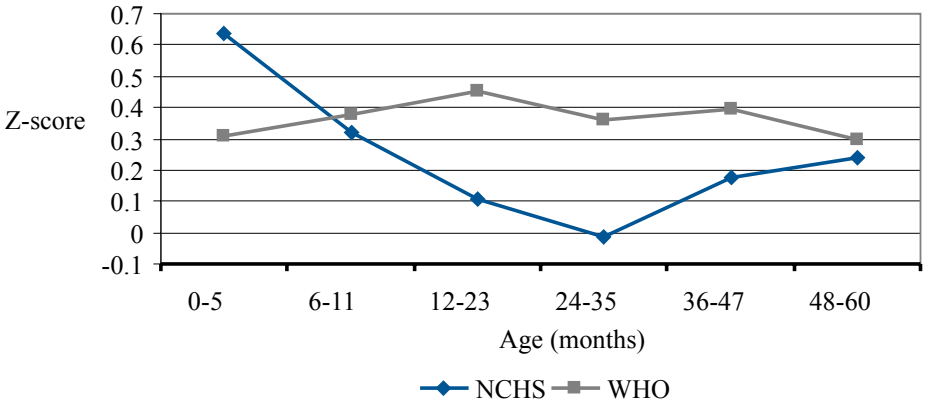
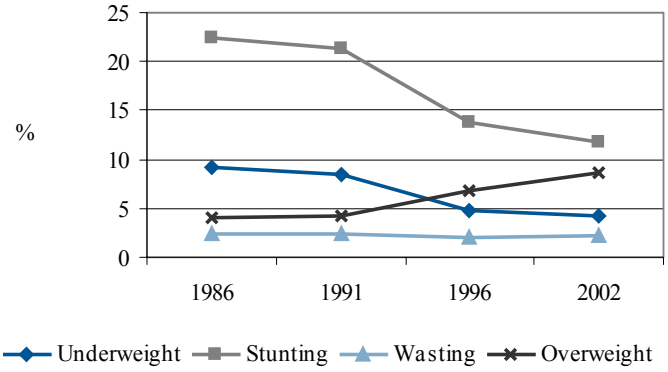


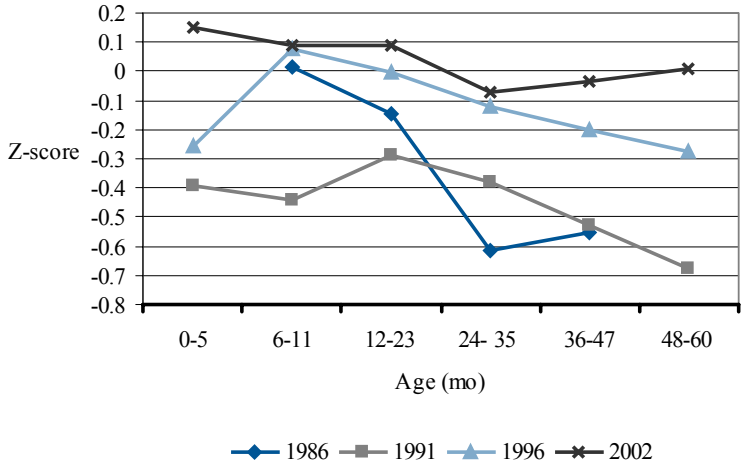
Figure 4.12: Five-month moving average for all anthropometric indicators using the WHO Standard, Dominican Republic, 2002.

Figure 4.13: Trends in prevalence of all anthropometric indicators for children under five, 1986-2002

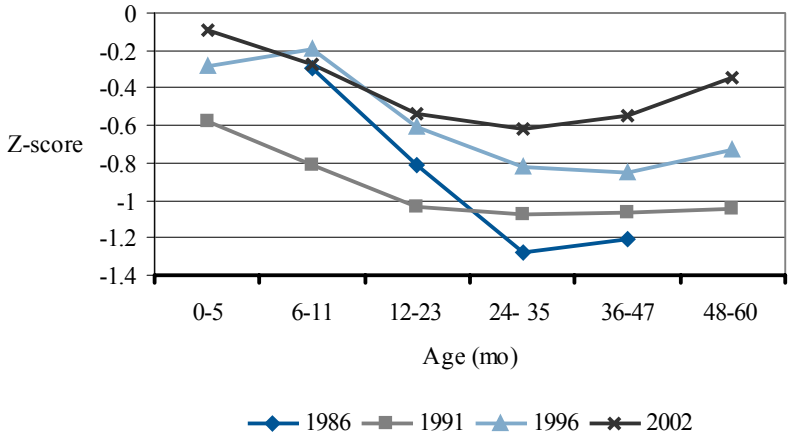


Figures 4.14-4.16: Trends in mean Z-scores by age groups, 1986-2002

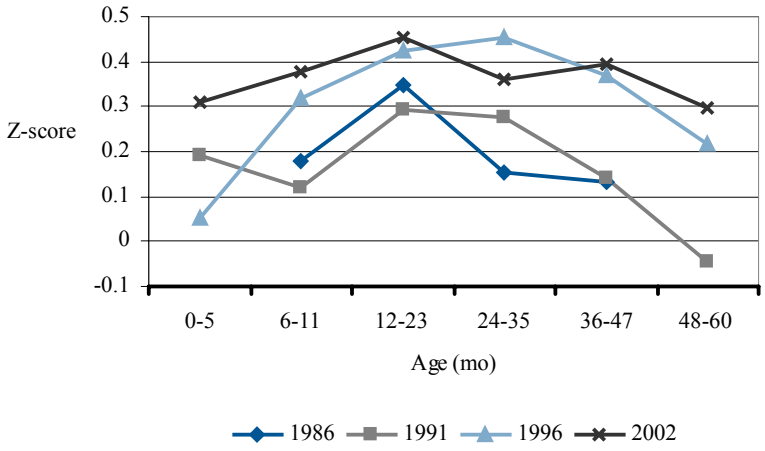
4.14 Dominican Republic: Trends in mean weight-for-age Z-score by age group and survey year



4.15 Dominican Republic: Trends in the mean length/height-for-age Z-score by age group and survey year

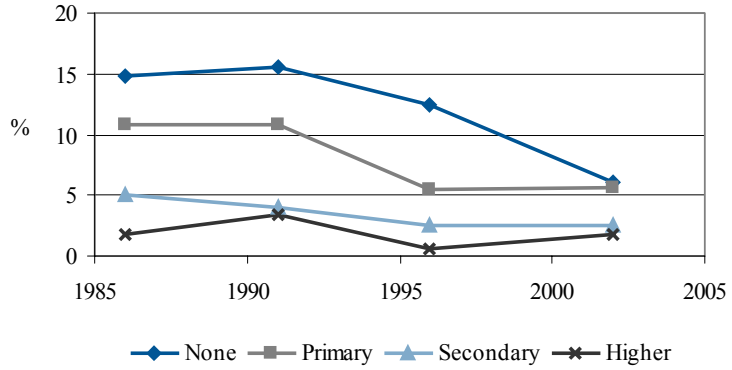


4.16 Dominican Republic: Trends in the mean weight-for-length/height Z-score by age group and survey year

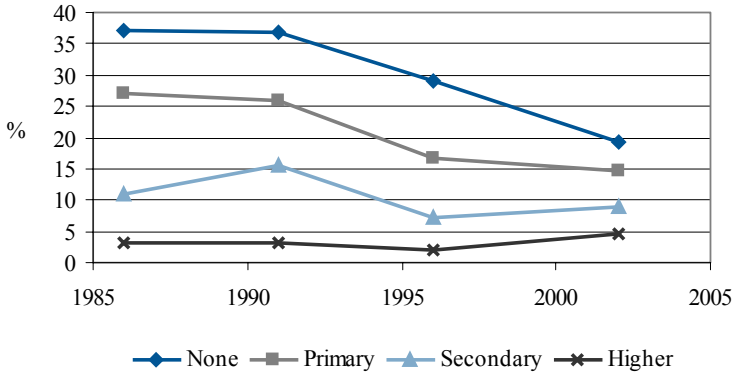


Figures 4.17-4.20: Trends in the prevalence of all anthropometric indicators by highest level of maternal education attained, 1986-2002

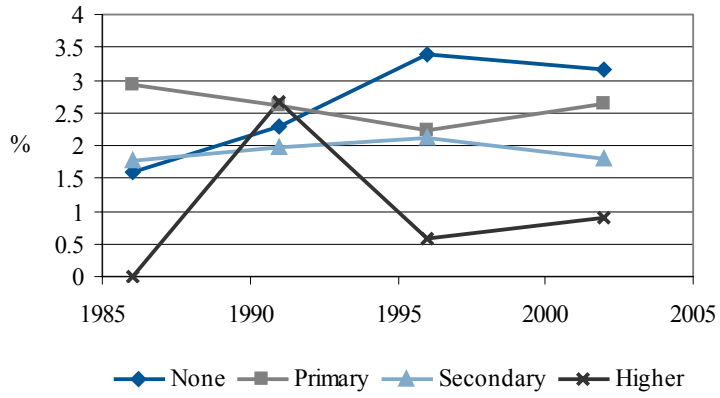
4.17 Dominican Republic: Prevalence of underweight by survey year and highest level of maternal education attained



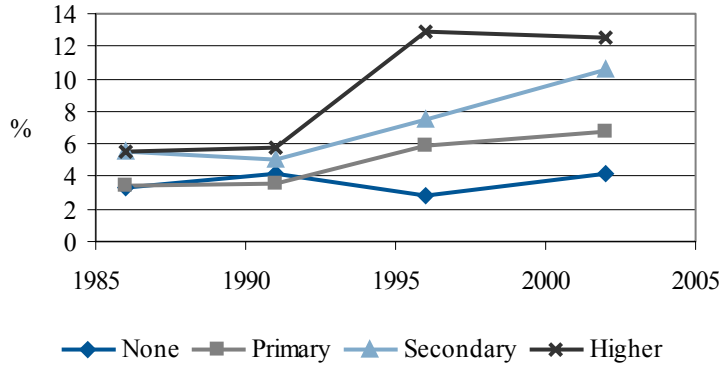
4.18 Dominican Republic: Prevalence of stunting by survey year and highest level of maternal education attained



4.19 Dominican Republic: Prevalence of wasting by survey year and highest level of maternal education attained



4.20 Dominican Republic: Prevalence of overweight by survey year and highest level of maternal education attained



Appendix 5

Ecuador, 2004

Table 5.1: Anthropometric data by reference (WHO vs. NCHS), residence, infant sex, region, and age groups

	Weight-for-age		Length/height-for-age		Weight-for-length/height			
	% <-3 SD	% < -2 SD	% < -3 SD	% <-2 SD	% < -3 SD	% < -2 SD	% >+2 SD	% >+3 SD
Reference								
NCHS	1.70	9.65	6.40	23.30	0.89	2.21	3.36	1.39
WHO	1.43	6.17	8.31	29.31	0.79	2.34	5.27	1.05
Residence								
Urban	0.85	4.60	4.75	22.52	0.70	2.35	5.38	1.26
Rural	2.14	8.07	12.62	37.53	0.89	2.33	5.15	0.80
Sex								
Male	1.54	6.39	8.87	31.12	1.04	2.32	5.35	1.07
Female	1.32	5.92	7.69	27.31	0.50	2.36	5.20	1.03
Region (Province)								
Azuay	0.56	4.48	14.37	40.00	0.00	1.13	6.23	0.57
Boliviar	2.24	14.70	19.00	45.17	1.87	4.67	6.85	2.18
Canar	2.94	8.82	17.45	45.97	0.34	3.38	8.11	1.35
Carchi	2.02	4.45	13.71	36.29	0.00	0.40	10.93	1.62
Cotopazi	2.39	11.26	19.38	38.75	0.34	4.79	3.42	0.68
Chimborazo	2.33	10.85	16.08	45.88	0.77	1.54	7.69	0.77
El Oro	0.00	4.71	6.10	17.98	0.72	1.82	4.12	0.67
Esmeraldas	1.98	6.23	6.23	20.11	0.84	3.63	2.79	1.12
Guayas	1.45	5.72	4.18	19.92	1.07	2.54	4.98	1.37
Imbabura	0.00	1.91	12.38	44.76	0.00	0.00	8.02	0.47
Loja	2.24	12.14	10.86	35.46	1.94	2.58	5.16	1.61
Los Rios	0.54	6.74	5.36	24.40	0.00	2.16	4.32	0.00
Manabi	0.76	4.03	3.77	23.62	0.25	2.54	4.06	1.02
Morona Santiago	0.76	2.29	3.88	26.36	0.00	2.34	3.13	0.00
Napo	21.43	21.43	19.05	47.62	9.30	16.28	0.00	0.00
Pastaza	2.08	4.17	10.42	35.42	6.25	8.33	0.00	0.00
Pichincha	0.67	4.26	8.79	33.42	0.53	1.20	5.47	0.80
Tungurahua	3.00	8.00	15.38	49.74	0.51	1.52	9.64	2.54
Zamora Chinchipe	6.67	11.67	22.03	54.24	1.67	1.67	10.00	3.33
Galapagos	4.04	8.08	3.92	18.63	1.06	7.45	27.66	11.70
Sucumbios	0.00	4.63	1.85	20.37	0.00	1.83	2.75	0.00
Orellana	5.56	16.67	14.71	29.41	5.71	5.71	11.43	2.86

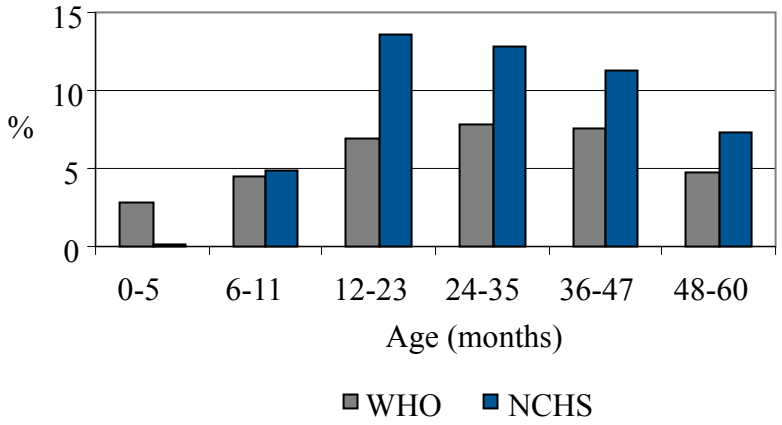
Continue >

Continue Table 5.1: Anthropometric data by reference (WHO vs. NCHS), residence, infant sex, region, and age groups

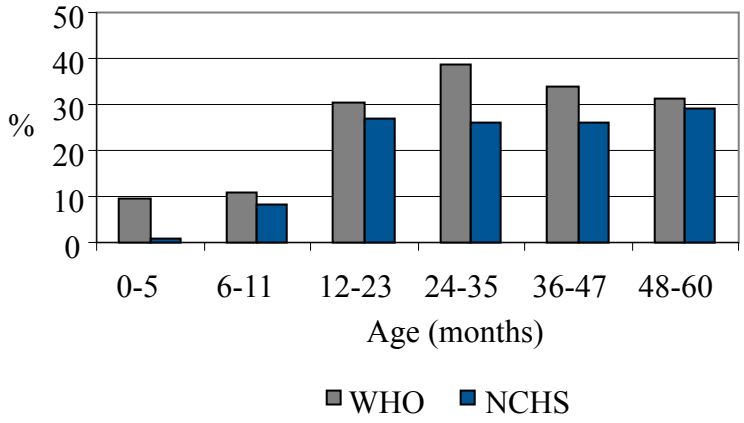
	Weight-for-age		Length/height-for-age		Weight-for-length/height			
	% <-3 SD	% < -2 SD	% < -3 SD	% <-2 SD	% < -3 SD	% < -2 SD	% >+2 SD	% >+3 SD
Age (WHO)								
0-5 mo	0.67	2.87	1.87	9.36	3.39	7.16	7.21	1.82
6-11 mo	1.73	4.43	2.64	11.00	1.64	5.45	3.11	0.66
12-23 mo	2.55	6.98	9.16	30.37	1.45	4.04	5.87	1.19
24-35 mo	1.94	7.84	13.03	38.50	0.25	1.57	5.55	0.99
36-47 mo	0.90	7.61	10.11	33.95	0.00	0.05	5.31	0.97
48-60 mo	0.59	4.68	6.49	31.14	0.07	0.46	4.49	0.96
Age (NCHS)								
0-5 mo	1.69	0.17	0.66	0.72	4.42	1.82	29.63	5.66
6-11 mo	1.29	4.86	1.96	8.13	1.79	4.04	4.03	1.31
12-23 mo	2.91	13.58	7.43	26.86	1.41	4.72	4.07	1.77
24-35 mo	2.72	12.81	7.76	25.94	0.36	1.65	2.24	1.00
36-47 mo	1.32	11.24	8.12	26.08	0.52	0.55	2.79	1.03
48-60 mo	0.75	7.32	6.84	28.98	0.52	0.91	3.19	1.57

Figures 5.1-5.4: Comparison of the prevalence of underweight, stunting, wasting and overweight using the WHO Standard vs. the NCHS reference, overall and by age group

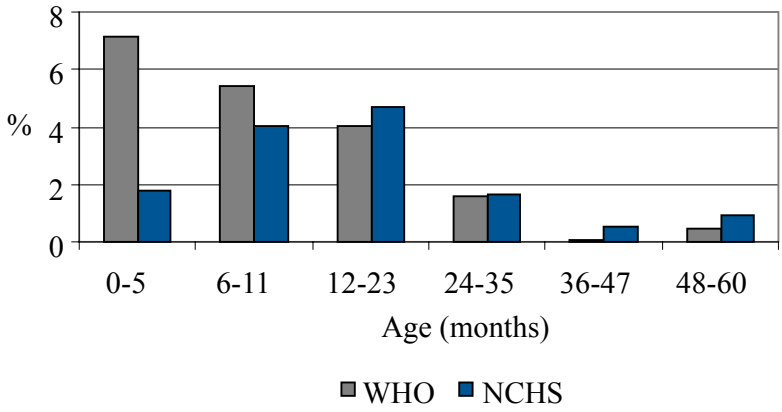
5.1 Ecuador, 2004: Comparison of prevalence of underweight using the WHO standard vs. NCHS reference



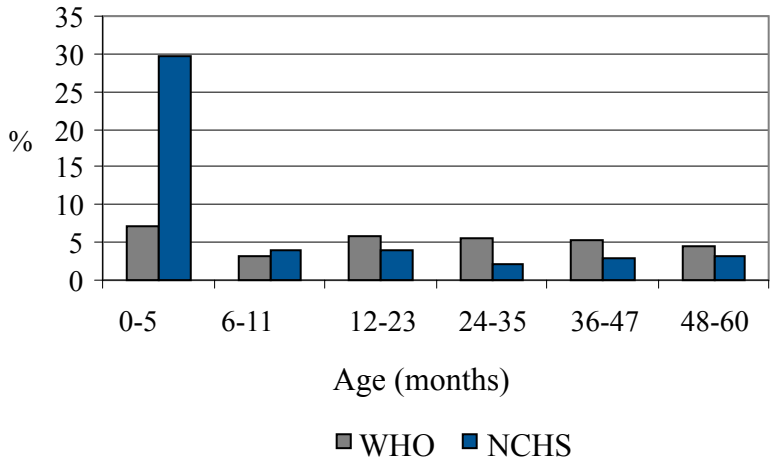
5.2 Ecuador, 2004: Comparison of prevalence of stunting using the WHO Standard vs. NCHS reference



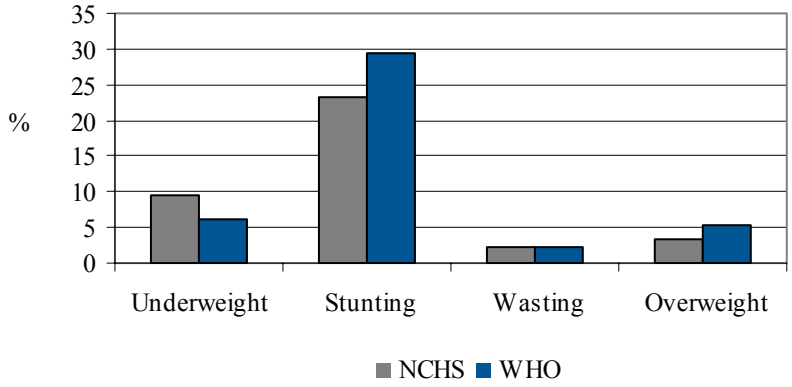
5.3 Ecuador, 2004: Comparison of prevalence of wasting using the WHO Standard vs. NCHS reference



5.4 Ecuador, 2004: Comparison of prevalence of overweight using the WHO Standard vs. NCHS reference

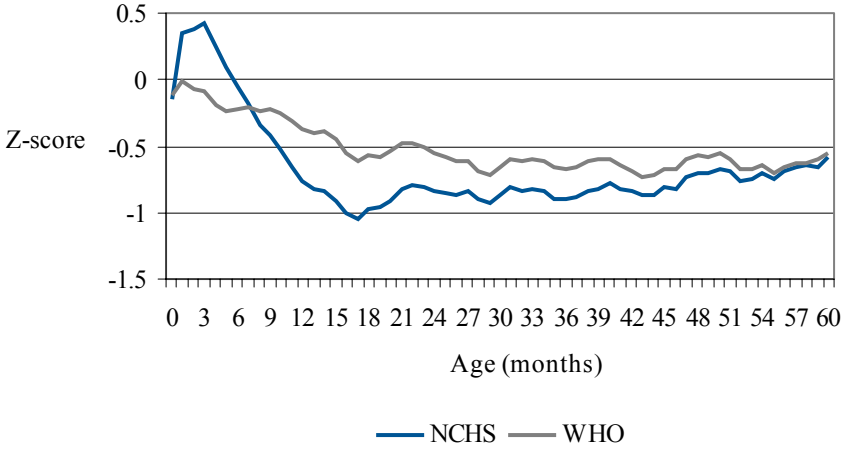


5.5 Ecuador, 2004: Comparison of the prevalence of underweight, stunting, wasting and overweight using the WHO Standard vs. NCHS reference

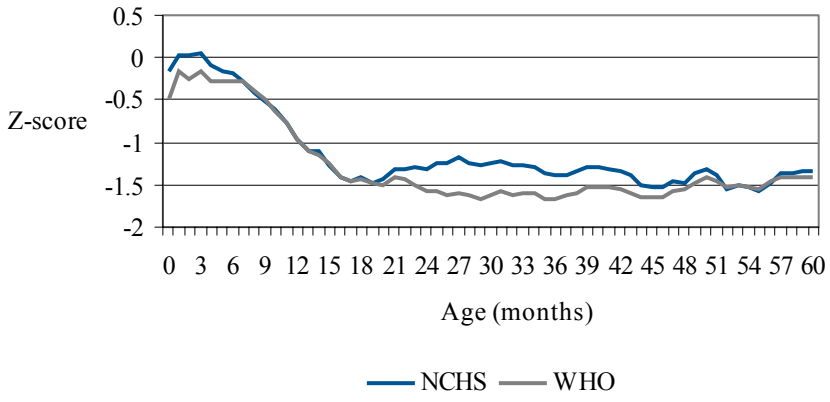


Figures 5.6-5.8: Comparison of five-month moving average Z-scores at each age using the WHO Standard vs. the NCHS reference

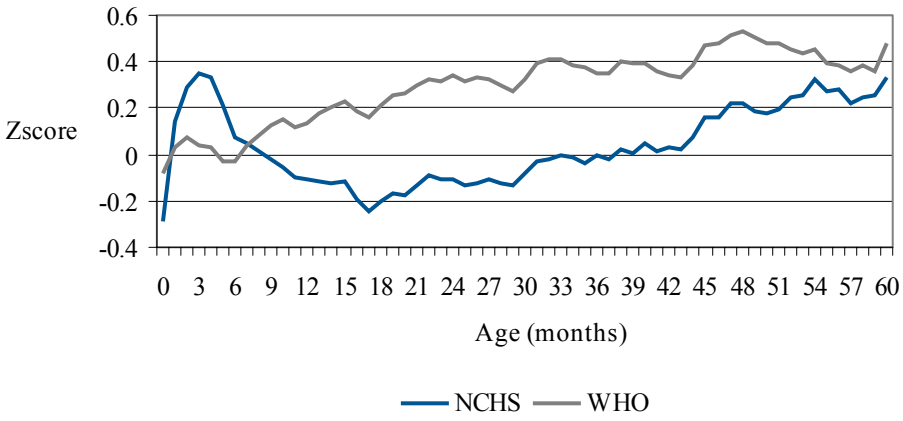
5.6 Ecuador, 2004: Moving average weight-for-age Z-score using the WHO Standard vs. NCHS reference



5.7 Ecuador, 2004: Moving average length/height-for-age Z-score using the WHO Standard vs. NCHS reference

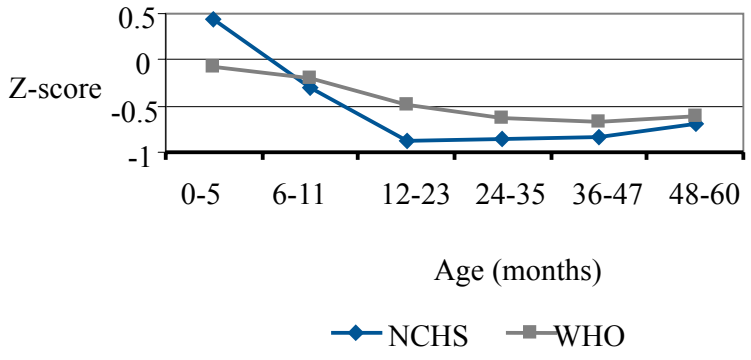


5.8 Ecuador, 2004: Moving average weight-for-length/height Z-score using the WHO Standard vs. NCHS reference

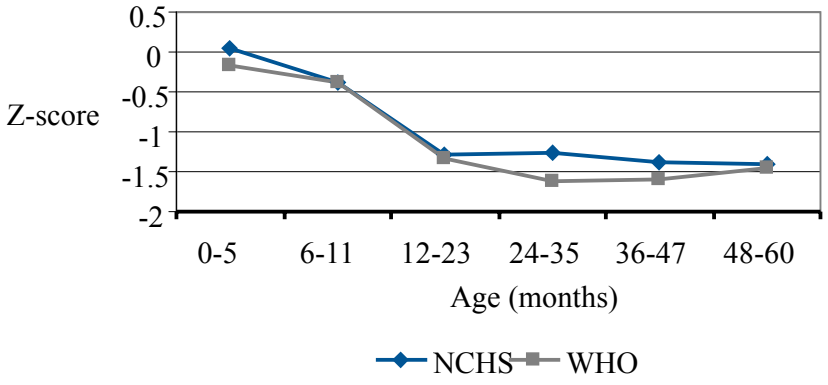


Figures 5.9-5.11: Comparison of mean Z-scores by age group using the WHO Standard vs. the NCHS reference

5.9 Ecuador, 2004: Comparison of mean weight-for-age Z-score by age group using the WHO Standard vs. NCHS reference



5.10 Ecuador, 2004: Comparison of mean length/height-for-age Z-score by age group using the WHO Standard vs. NCHS reference



5.11 Ecuador, 2004: Comparison of mean weight-for-length/height Z-score by age group using the WHO Standard vs. NCHS reference

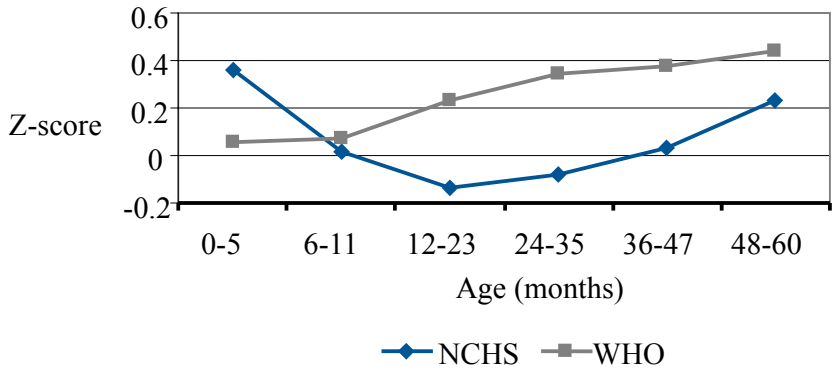
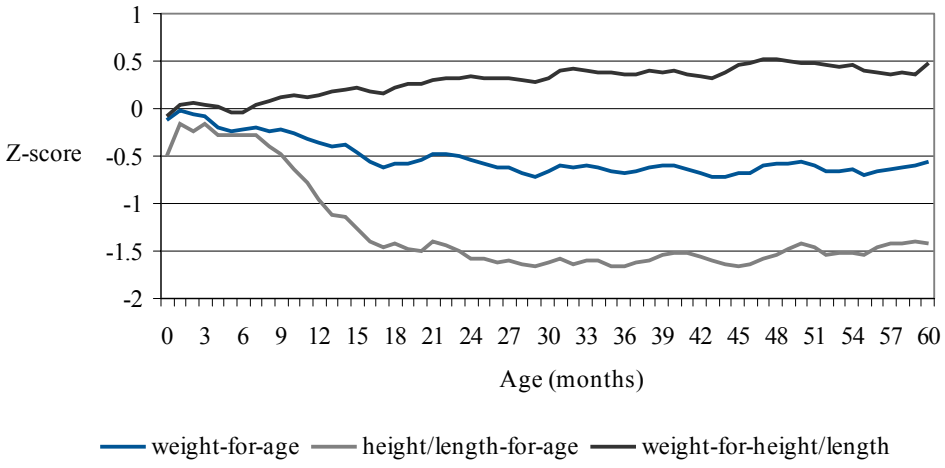


Figure 5.12: Five-month moving average for all anthropometric indicators using the WHO Standard, Ecuador, 2004.



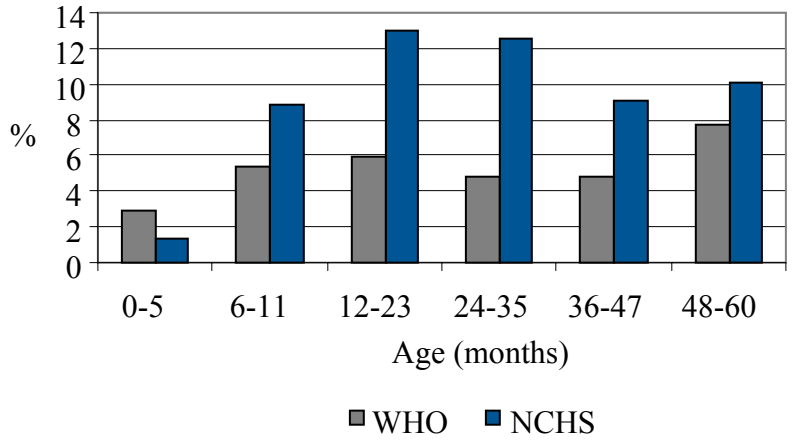
Appendix 6
El Salvador, 2003

Table 6.1: Anthropometric data by reference (WHO vs. NCHS), residence, infant sex, region, and age groups

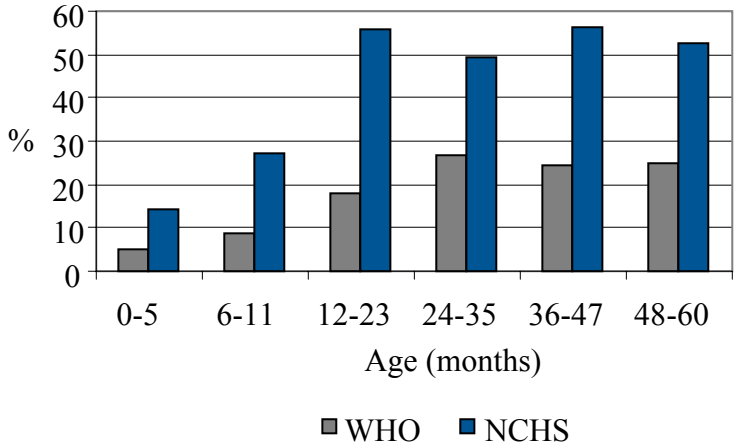
	Weight-for-age		Length/height-for-age		Weight-for-length/height			
	% <-3 SD	% < -2 SD	% < -3 SD	% < -2 SD	% < -3 SD	% < -2 SD	% >+2 SD	% >+3 SD
Reference								
NCHS	0.77	9.90	4.71	18.34	0.35	1.35	4.48	1.51
WHO	0.82	5.49	5.31	20.76	0.25	1.53	5.50	1.23
Residence								
Urban	0.34	3.08	2.61	12.50	0.18	1.68	6.92	1.43
Rural	1.23	7.55	7.63	27.86	0.31	1.40	4.28	1.06
Sex								
Male	1.15	6.18	5.47	20.71	0.19	1.79	5.92	1.43
Female	0.44	4.70	5.13	20.82	0.32	1.24	5.02	1.01
Region								
Ahuachapan	0.96	12.12	15.80	39.82	0.10	0.99	3.83	1.04
Santa Ana	1.80	7.19	7.69	27.45	1.57	2.71	4.89	0.49
Sonsonate	0.61	6.24	5.68	27.22	0.00	1.46	3.97	0.71
Chalatenango	1.14	7.82	5.09	24.88	0.83	3.05	5.23	1.22
La Libertad	2.00	6.01	4.33	23.14	0.00	1.07	5.97	1.89
San Salvador	0.42	3.78	3.31	13.22	0.17	1.40	6.76	1.32
Cuscatlan	0.65	4.51	7.65	32.72	0.00	0.20	3.55	0.81
La Paz	0.15	4.30	6.10	18.34	0.33	3.04	5.09	0.48
Cabanas	0.58	6.92	7.52	21.74	0.00	1.88	6.85	1.28
San Vicente	0.70	8.88	4.36	13.81	0.00	1.97	4.25	0.78
Usulutan	0.56	3.11	1.41	13.06	0.29	0.29	4.30	0.75
San Miguel	1.44	4.68	4.58	15.71	0.00	0.27	5.38	1.89
Morazan	0.00	3.01	5.10	23.85	0.00	1.92	7.44	1.89
La Union	0.70	4.00	2.22	19.58	0.00	1.59	6.08	3.27
Age (WHO)								
0-5 mo	1.58	2.87	1.20	5.29	0.12	4.35	8.04	0.95
6-11 mo	0.95	5.40	2.07	8.86	0.56	0.91	7.23	2.69
12-23 mo	0.88	5.98	5.92	18.21	0.21	1.62	5.75	1.16
24-35 mo	0.51	4.81	5.62	26.88	0.30	1.04	4.57	0.58
36-47 mo	0.58	4.82	6.48	24.56	0.06	1.27	5.21	1.66
48-60 mo	0.86	7.75	6.49	24.90	0.37	0.97	4.64	1.22
Age (NCHS)								
0-5 mo	0.00	1.31	1.19	5.06	0.11	0.11	8.91	1.50
6-11 mo	0.65	8.84	1.65	10.97	0.56	0.64	6.62	3.50
12-23 mo	1.45	13.03	6.02	19.52	1.06	3.33	5.02	1.48
24-35 mo	0.71	12.56	4.12	18.77	0.18	1.04	2.37	0.33
36-47 mo	0.57	9.05	4.95	20.19	0.14	1.23	3.81	1.74
48-60 mo	0.85	10.04	6.74	24.34	0.16	0.91	3.89	1.86

Figures 6.1-6.4: Comparison of the prevalence of underweight, stunting, wasting and overweight using the WHO Standard vs. the NCHS reference, overall and by age group

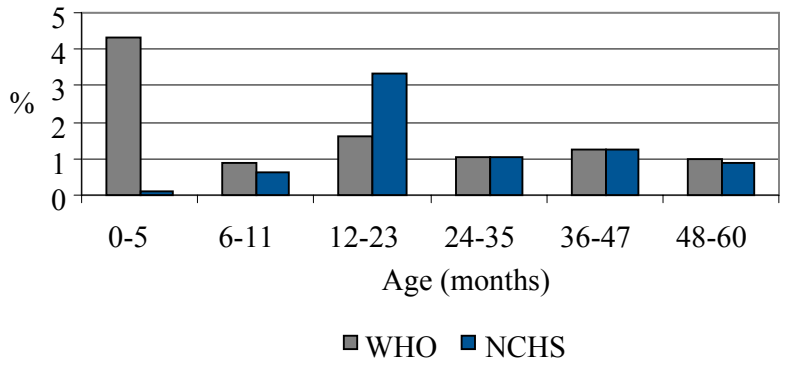
6.1 El Salvador, 2003: Comparison of prevalence of underweight using the WHO standard vs. NCHS reference



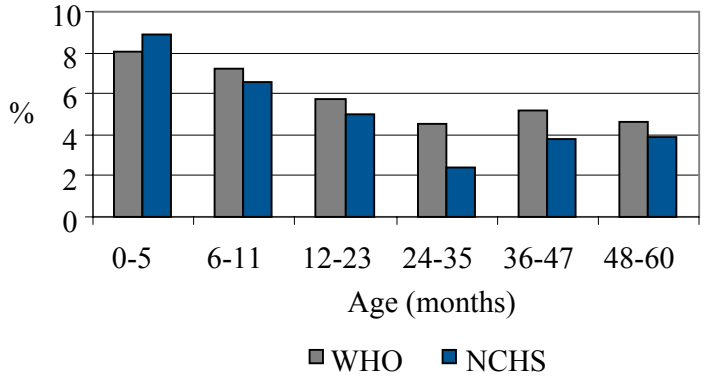
6.2 El Salvador, 2003: Comparison of prevalence of stunting using the WHO Standard vs. NCHS reference



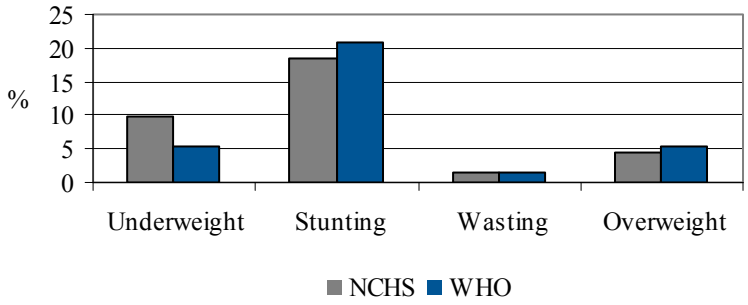
6.3 El Salvador, 2003: Comparison of prevalence of wasting using the WHO Standard vs. NCHS reference



6.4 El Salvador, 2003: Comparison of prevalence of overweight using the WHO Standard vs. NCHS reference

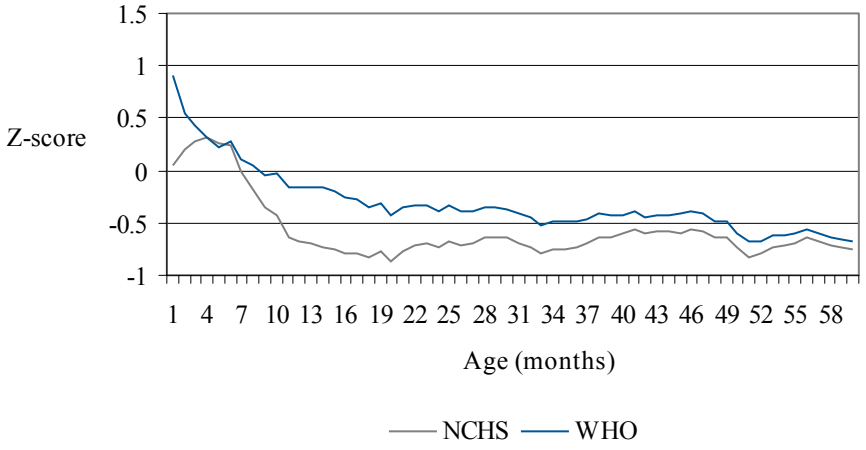


6.5 El Salvador, 2003: Comparison of the prevalence of underweight, stunting, wasting and overweight using the WHO Standard vs. NCHS reference

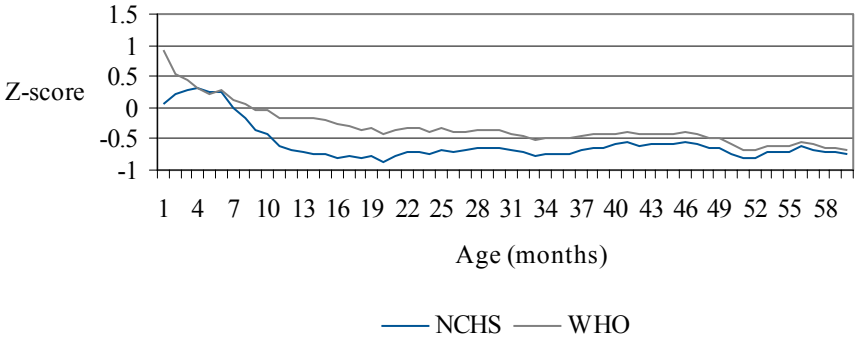


Figures 6.6-6.8: Comparison of five-month moving average Z-scores at each age using the WHO Standard vs. the NCHS reference

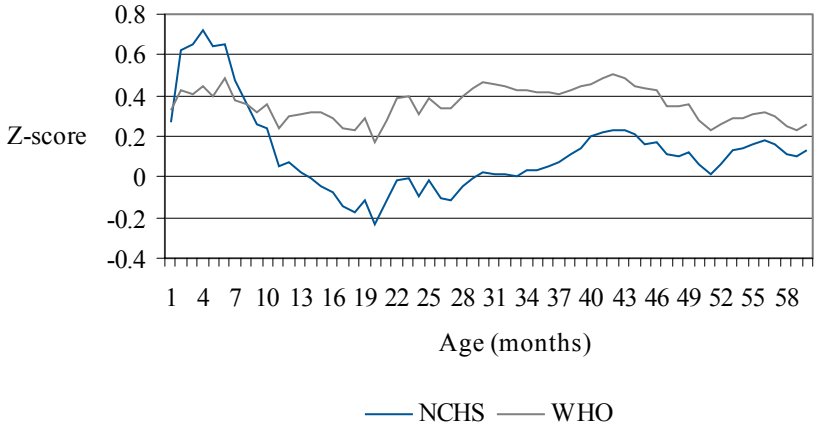
6.6 El Salvador, 2003: Moving average weight-for-age Z-score using the WHO Standard vs. NCHS reference



6.7 El Salvador, 2003: Moving average length/height-for-age Z-score using the WHO Standard vs. NCHS reference

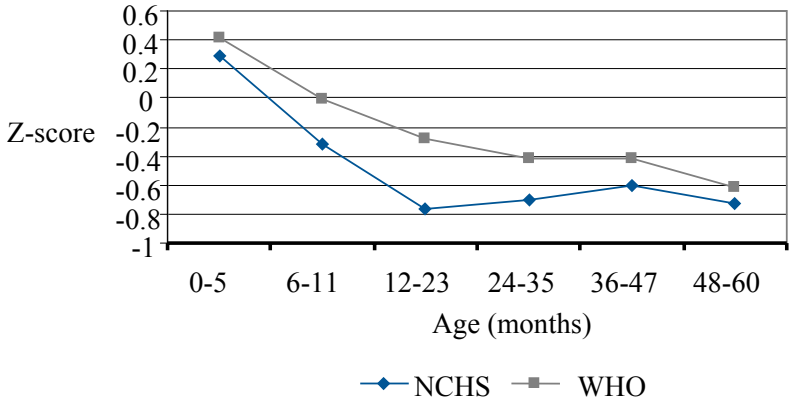


6.8 El Salvador, 2003: Moving average weight-for-length/height Z-score using the WHO Standard vs. NCHS reference

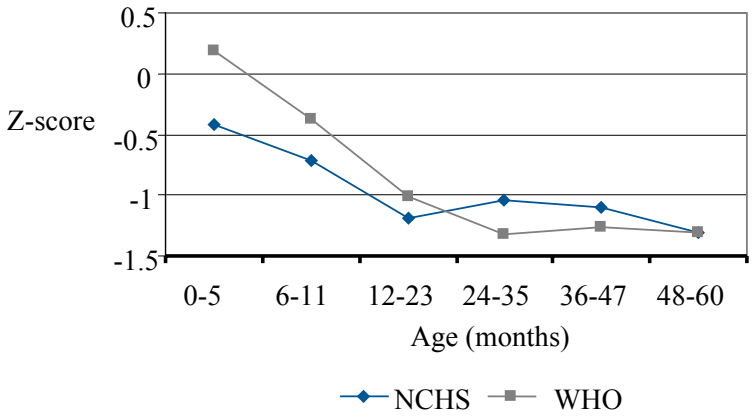


Figures 6.9-6.11: Comparison of mean Z-scores by age group using the WHO Standard vs. the NCHS reference

6.9 El Salvador, 2003: Comparison of mean weight-for-age Z-score by age group using the WHO Standard vs. NCHS reference



6.10 El Salvador, 2003: Comparison of mean length/height-for-age Z-score by age group using the WHO Standard vs. NCHS reference



6.11 El Salvador, 2003: Comparison of mean weight-for-length/height Z-score by age group using the WHO Standard vs. NCHS reference

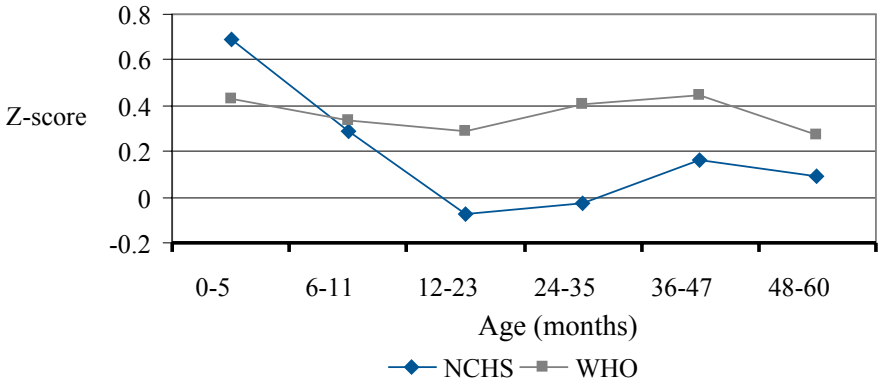


Figure 6.12: Five-month moving average for all anthropometric indicators using the WHO Standard, El Salvador, 2003.

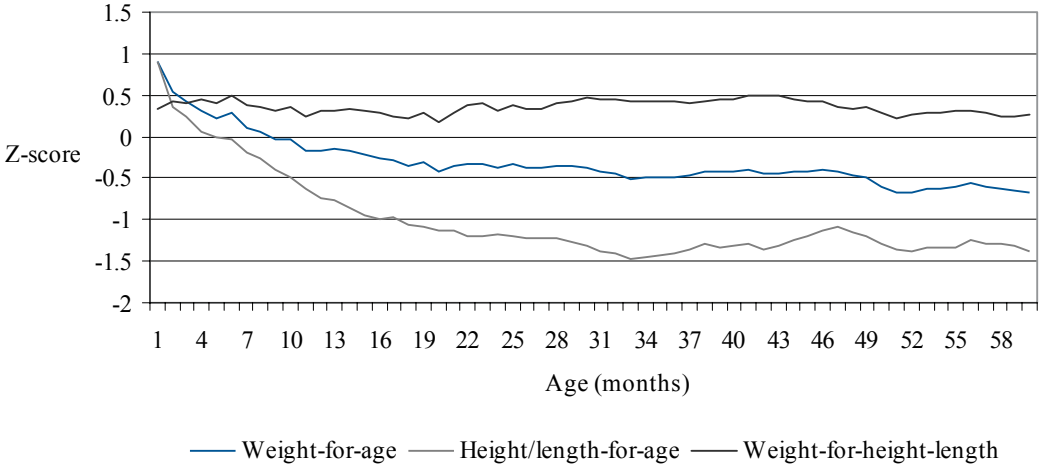
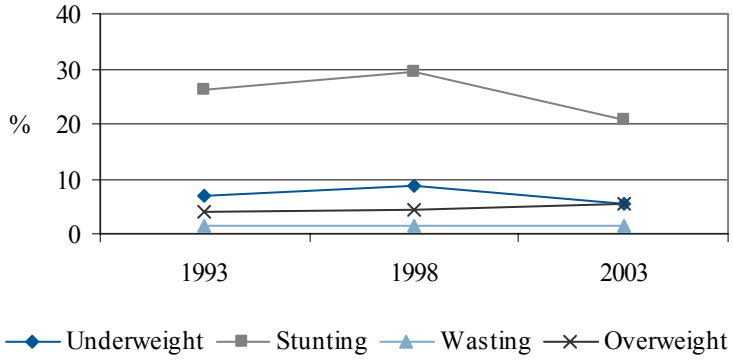
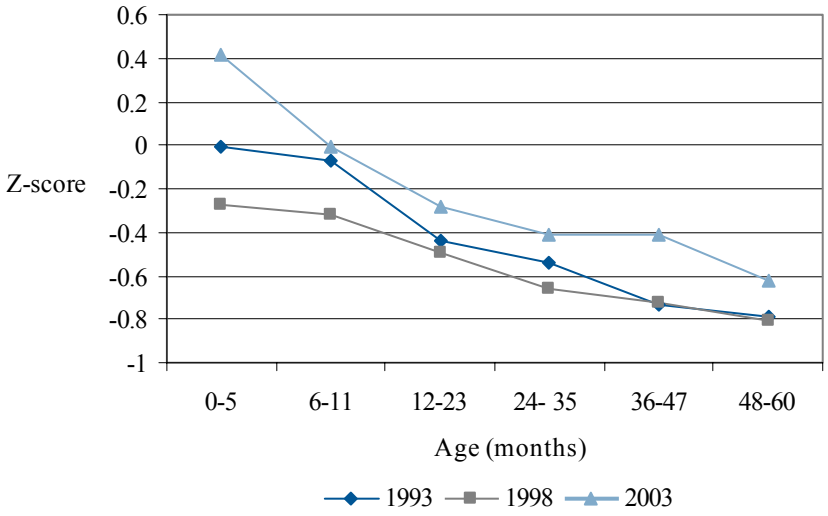


Figure 6.13: Trends in prevalence of all anthropometric indicators for children under five, El Salvador, 1993-2003.

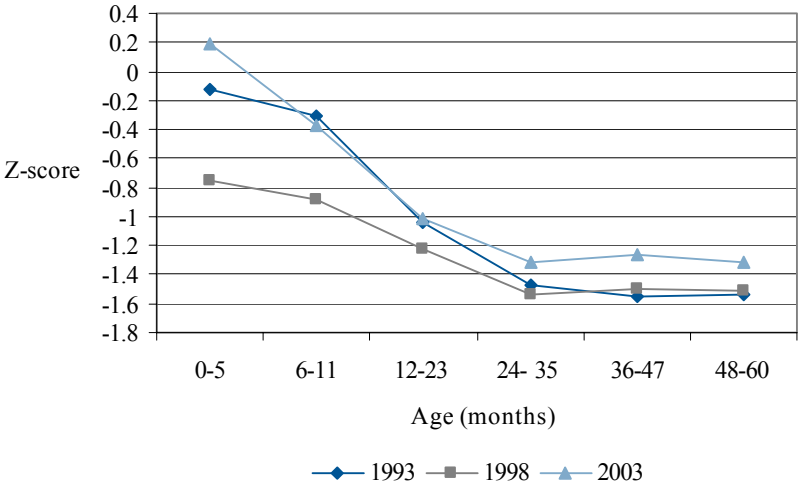


Figures 6.14-6.16: Trends in mean Z-scores by age groups, 1993-2003

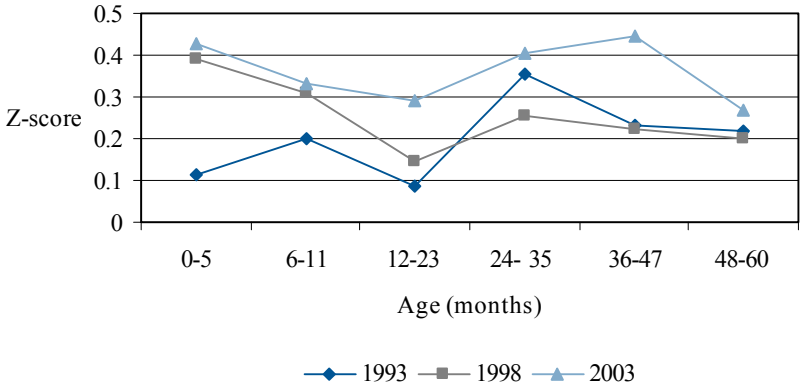
6.14 El Salvador: Trends in mean weight-for-age Z-score by age group and survey year



6.15 El Salvador: Trends in the mean length/height-for-age Z-score by age group and survey year

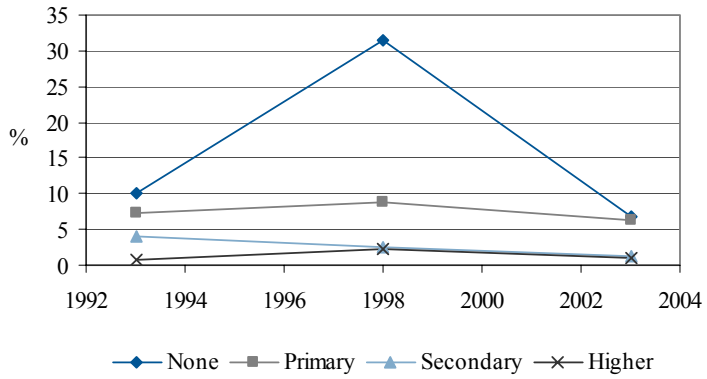


6.16 El Salvador: Trends in the mean weight-for-length/height Z-score by age group and survey year

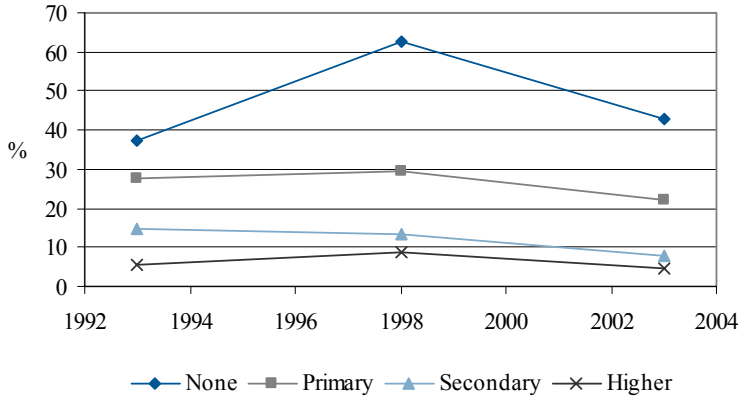


Figures 6.17-6.20: Trends in the prevalence of all anthropometric indicators by highest level of maternal education attained, 1993-2003

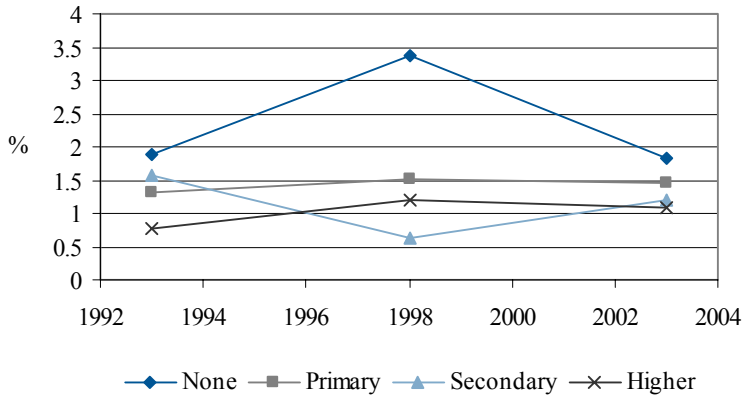
6.17 El Salvador: Prevalence of underweight by survey year and highest level of maternal education attained



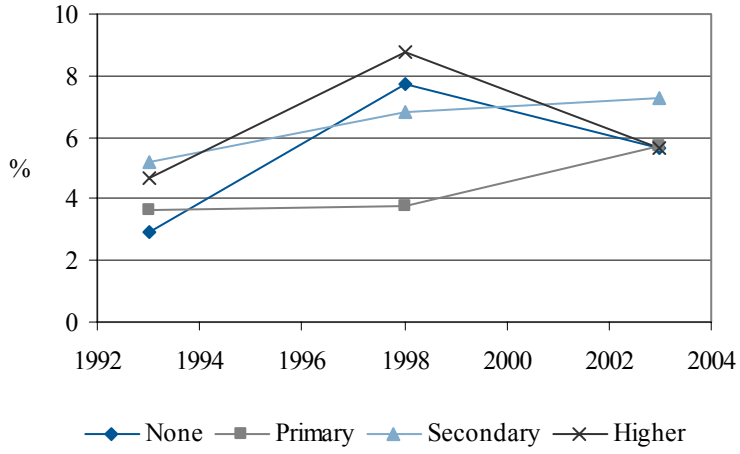
6.18 El Salvador: Prevalence of stunting by survey year and highest level of maternal education attained



6.19 El Salvador: Prevalence of wasting by survey year and highest level of maternal education attained



6.20 El Salvador: Prevalence of overweight by survey year and highest level of maternal education attained



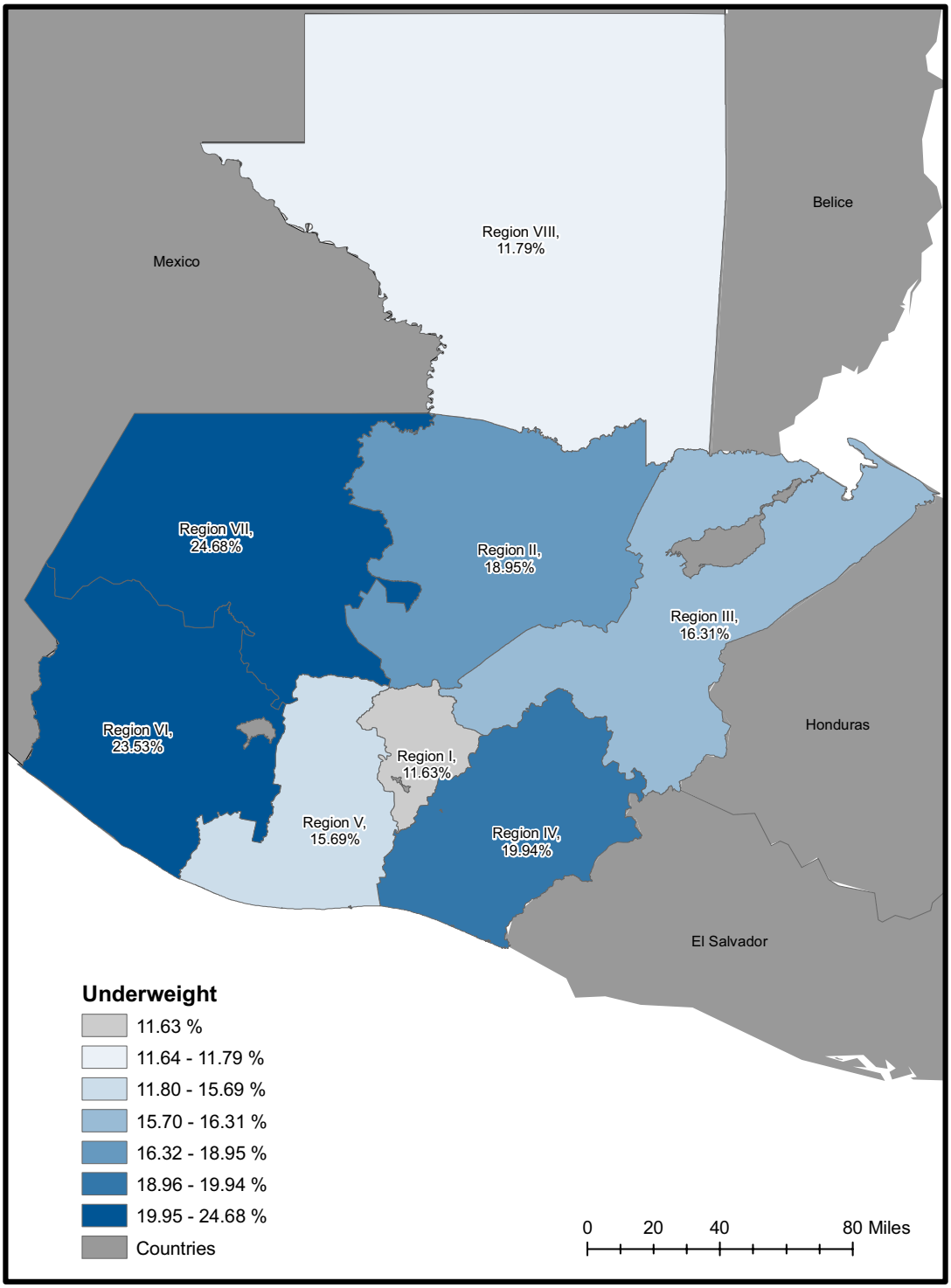
Appendix 7

Guatemala, 2002

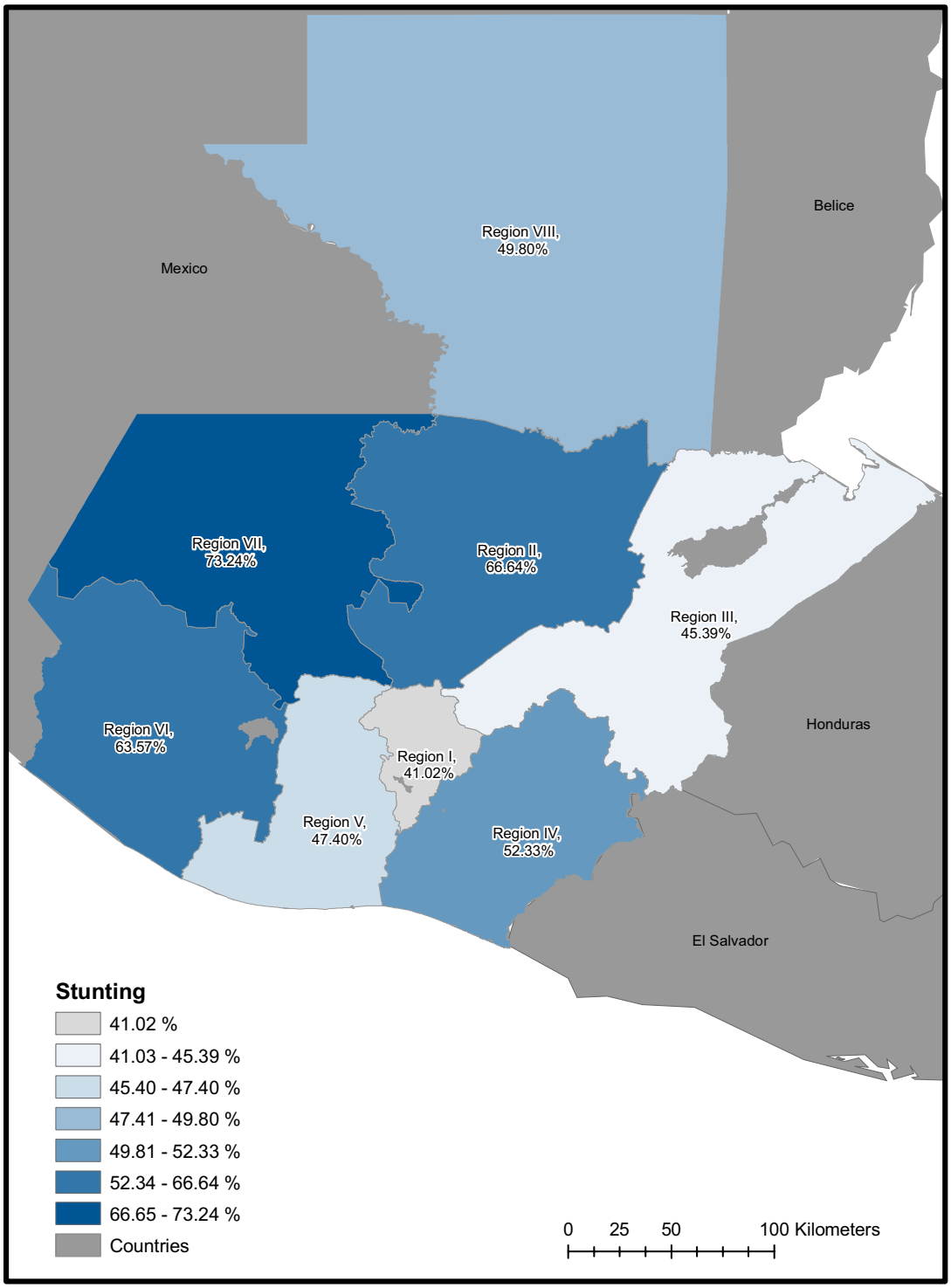
Table 7.1: Anthropometric data by reference (WHO vs. NCHS), residence, infant sex, region, and age groups

	Weight-for-age		Length/height-for-age		Weight-for-length/height			
	% <-3 SD	% < -2 SD	% < -3 SD	% < -2 SD	% < -3 SD	% < -2 SD	% >+2 SD	% >+3 SD
Reference								
WHO	4.00	18.02	27.02	54.47	0.75	1.85	5.71	1.28
NCHS	3.86	22.90	21.64	49.60	0.53	1.84	4.27	1.42
Residence								
Urban	2.21	12.47	18.52	41.57	0.77	1.53	7.56	1.92
Rural	4.88	20.74	31.20	60.82	0.75	2.01	4.79	0.97
Sex								
Male	4.29	18.11	28.15	54.73	0.91	2.11	6.44	1.16
Female	3.72	17.93	25.88	54.22	0.60	1.59	4.97	1.40
Region								
Metropolitana	1.56	11.63	17.83	41.02	0.69	1.33	7.38	1.71
Norte	4.63	18.95	33.06	66.64	0.42	1.17	7.02	1.42
Nor-Oriente	5.08	16.31	19.30	45.39	1.84	4.08	5.92	1.57
Sur-oriente	3.05	19.94	22.02	52.33	0.10	1.98	2.01	0.56
Central	3.18	15.69	21.34	47.40	0.68	1.36	3.39	0.50
Sur-Occidente	5.49	23.53	34.68	63.57	0.81	1.76	5.77	0.78
Nor-Occidente	6.97	24.68	45.41	73.24	0.45	1.78	6.71	2.36
Peten	2.42	11.79	20.93	49.80	1.56	2.61	3.94	0.99
Age (WHO)								
0-5 mo	5.61	8.92	6.85	22.61	3.17	3.41	16.34	4.04
6-11 mo	3.28	11.11	10.85	33.53	2.61	3.58	11.02	3.32
12-23 mo	5.80	20.55	31.93	58.73	1.09	3.81	4.56	0.65
24-35 mo	4.79	19.43	31.18	58.19	0.55	1.75	2.45	0.34
36-47 mo	3.81	19.01	30.94	62.72	0.16	0.52	5.68	1.43
48-60 mo	1.87	18.07	25.60	54.53	0.02	0.41	5.78	1.12
Age (NCHS)								
0-5 mo	1.06	5.40	3.15	14.24	0.45	2.58	20.28	5.24
6-11 mo	2.70	12.27	6.51	27.08	1.44	3.41	11.22	3.50
12-23 mo	7.03	30.50	26.66	55.92	0.86	4.14	3.13	0.88
24-35 mo	5.26	25.97	20.12	49.56	0.62	1.70	0.76	0.17
36-47 mo	3.64	22.17	24.73	56.40	0.09	0.55	2.83	0.36
48-60 mo	1.50	21.21	24.84	52.56	0.28	0.56	3.96	1.12

Map 7.2: Prevalence of underweight by region, Guatemala, 2002

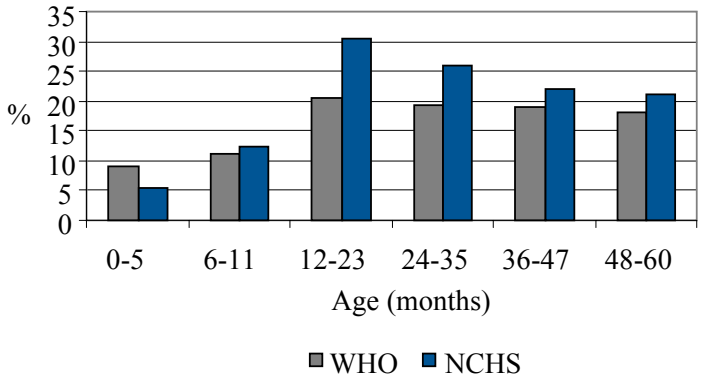


Map 7.3: Prevalence of stunting by region, Guatemala, 2002

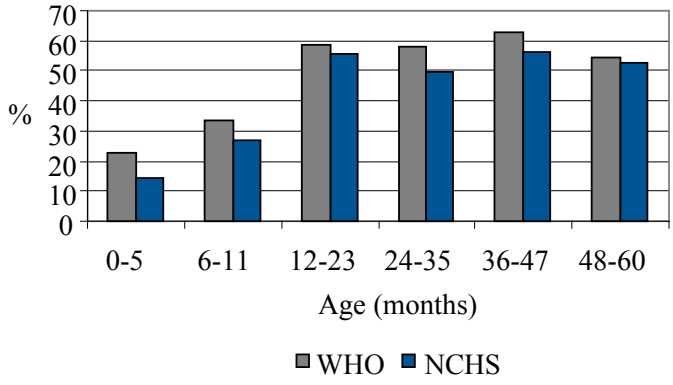


Figures 7.1-7.4: Comparison of the prevalence of underweight, stunting, wasting and overweight using the WHO Standard vs. the NCHS reference, overall and by age group

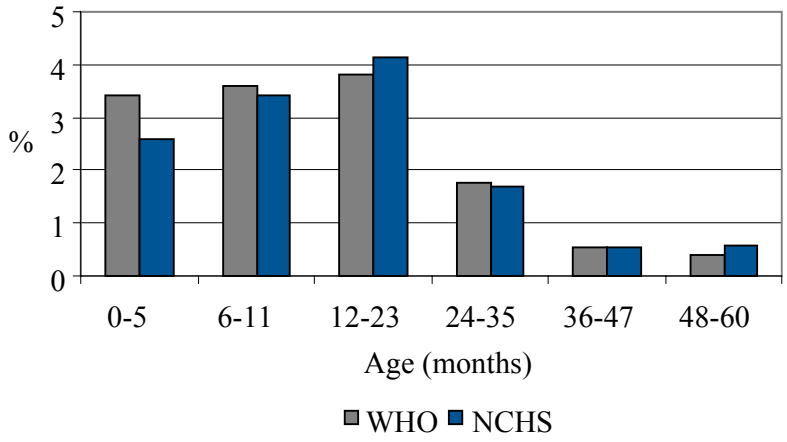
7.1 Guatemala, 2002: Comparison of prevalence of underweight using the WHO standard vs. NCHS reference



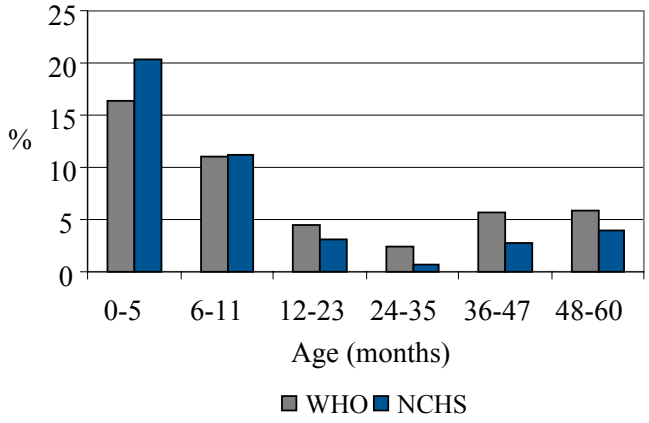
7.2 Guatemala, 2002: Comparison of prevalence of stunting using the WHO Standard vs. NCHS reference



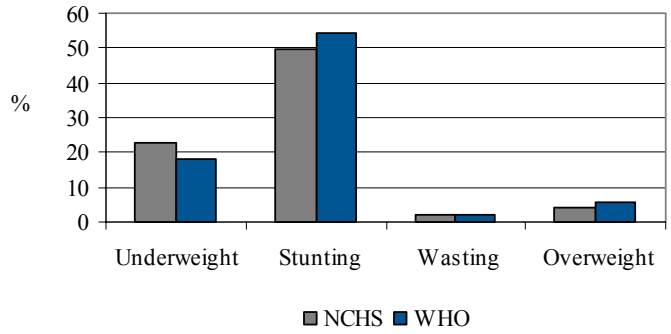
7.3 Guatemala, 2002: Comparison of prevalence of wasting using the WHO Standard vs. NCHS reference



7.4 Guatemala, 2002: Comparison of prevalence of overweight using the WHO Standard vs. NCHS reference

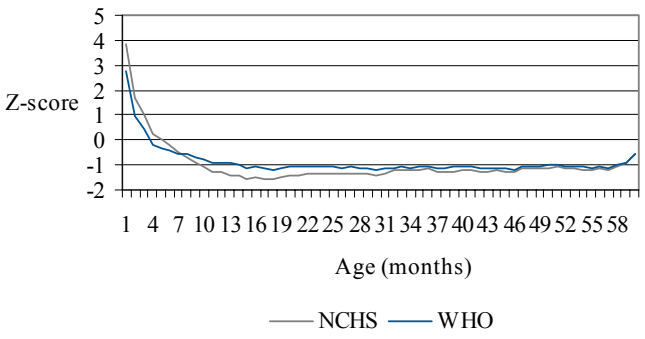


7.5 Guatemala, 2002: Comparison of the prevalence of underweight, stunting, wasting and overweight using the WHO Standard vs. NCHS reference

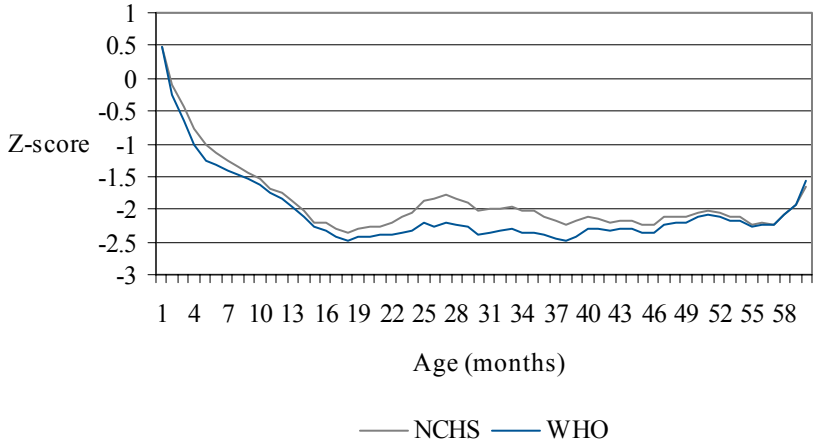


Figures 7.6-7.8: Comparison of five-month moving average Z-scores at each age using the WHO Standard vs. the NCHS reference

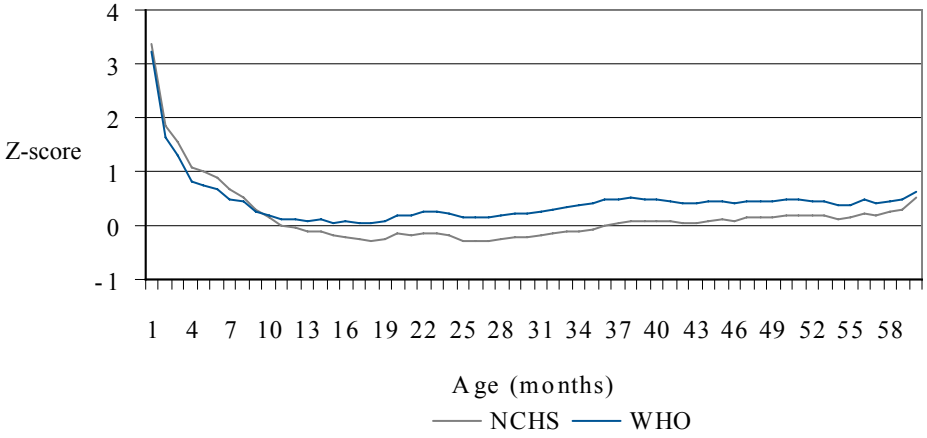
7.6 Guatemala, 2002: Moving average weight-for-age Z-score using the WHO Standard vs. NCHS reference



7.7 Guatemala, 2002: Moving average length/height-for-age Z-score using the WHO Standard vs. NCHS reference

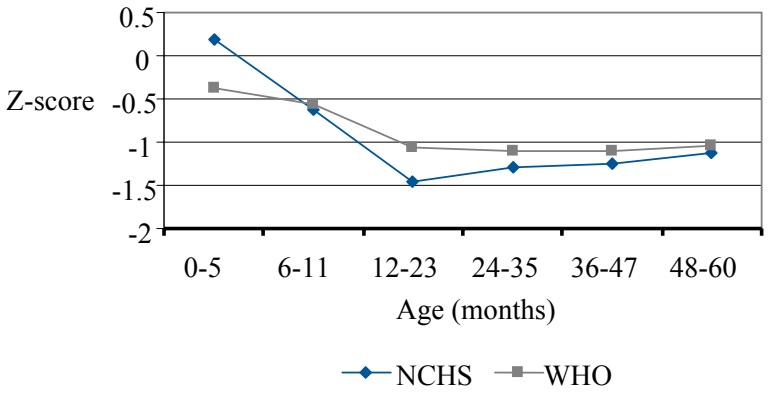


7.8 Guatemala, 2002: Moving average weight-for-length/height Z-score using the WHO Standard vs. NCHS reference

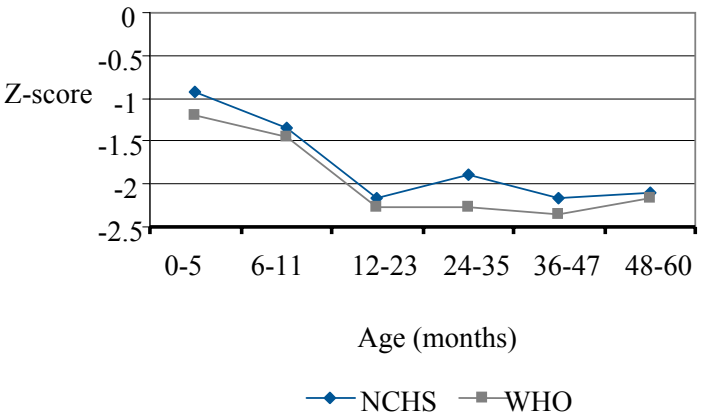


Figures 7.9-7.11: Comparison of mean Z-scores by age group using the WHO Standard vs. the NCHS reference

7.9 Guatemala, 2002: Comparison of mean weight-for-age Z-score by age group using the WHO Standard vs. NCHS reference



7.10 Guatemala, 2002: Comparison of mean length/height-for-age Z-score by age group using the WHO Standard vs. NCHS reference



7.11 Guatemala, 2002: Comparison of mean weight-for-length/height Z-score by age group using the WHO Standard vs. NCHS reference

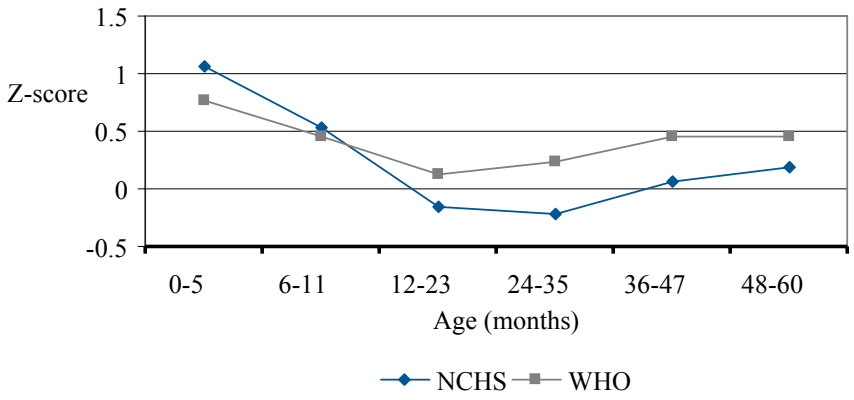


Figure 7.12: Five-month moving average for all anthropometric indicators using the WHO Standard, Guatemala, 2002.

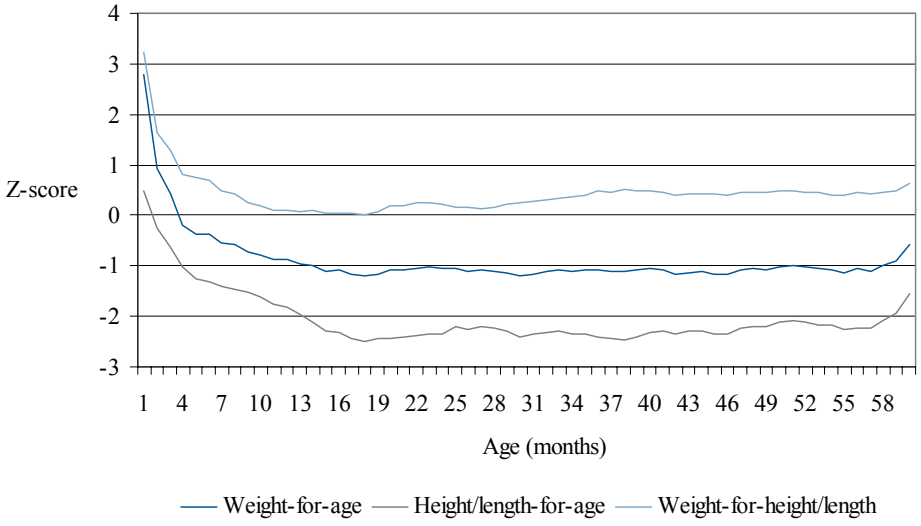
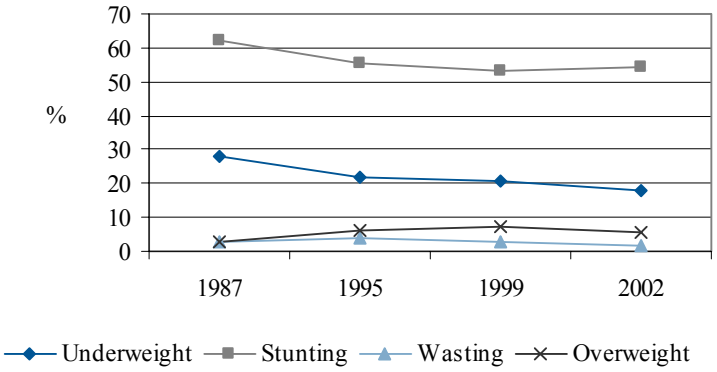
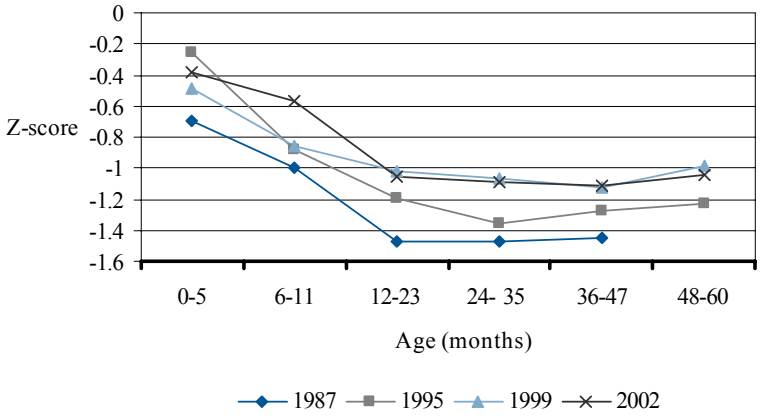


Figure 7.13: Trends in prevalence of all anthropometric indicators for children under five, Guatemala, 1987-2002

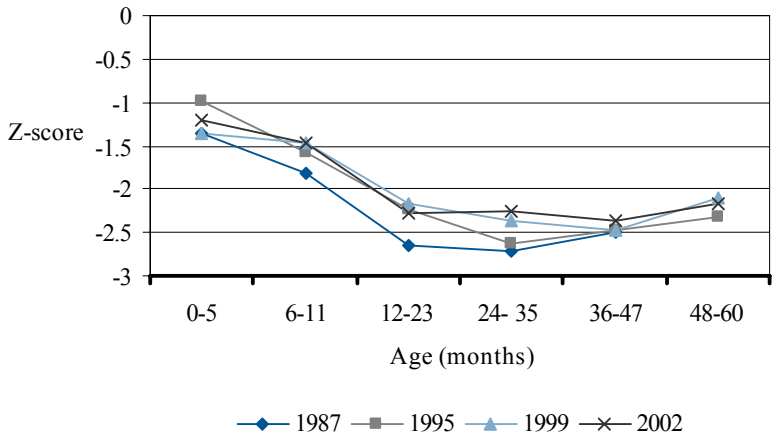


Figures 7.14-7.16: Trends in mean Z-scores by age groups, 1987-2002

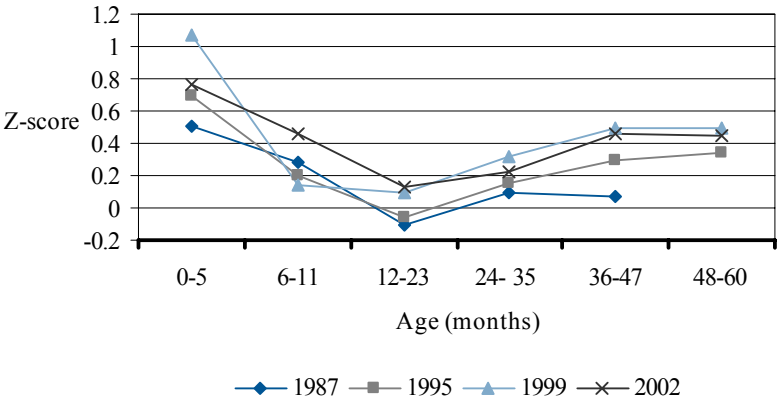
7.14 Guatemala, 2002: Trends in mean weight-for-age Z-score by age group and survey year



7.15 Guatemala: Trends in the mean length/height-for-age Z-score by age group and survey year

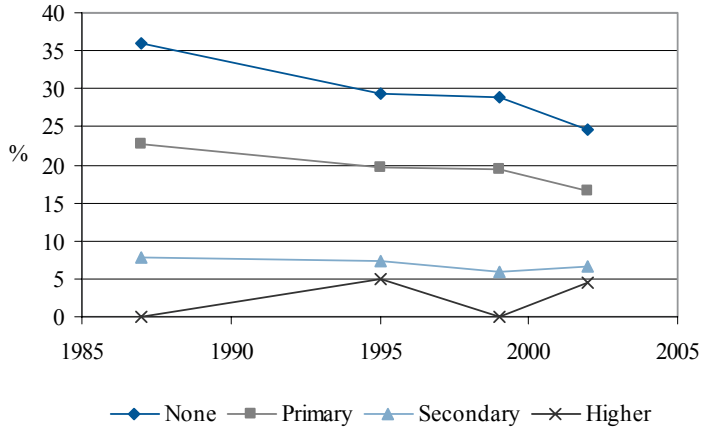


7.16 Guatemala: Trends in the mean weight-for-length/height Z-score by age group and survey year

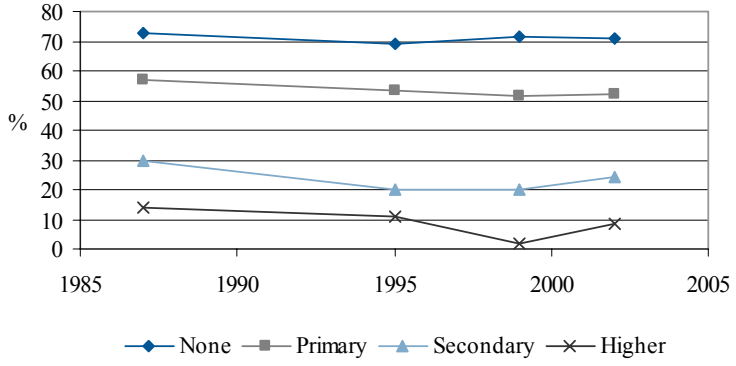


Figures 7.17-7.20: Trends in the prevalence of all anthropometric indicators by highest level of maternal education attained, 1987-2002

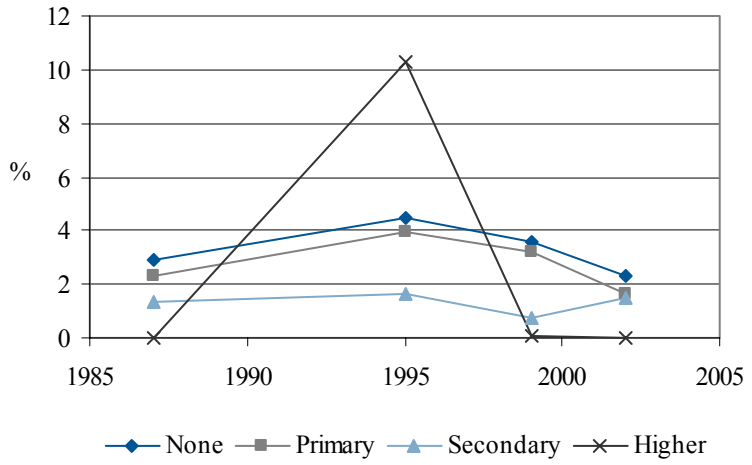
7.17 Guatemala: Prevalence of underweight by survey year and highest level of maternal education attained



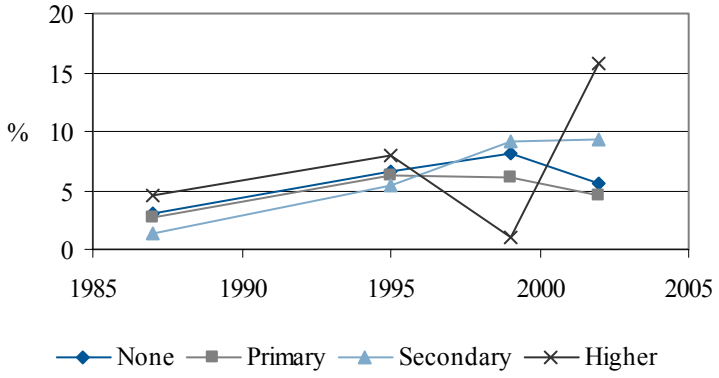
7.18 Guatemala: Prevalence of stunting by survey year and highest level of maternal education attained



7.19 Guatemala: Prevalence of wasting by survey year and highest level of maternal education attained



7.20 Guatemala: Prevalence of overweight by survey year and highest level of maternal education attained



Appendix 8

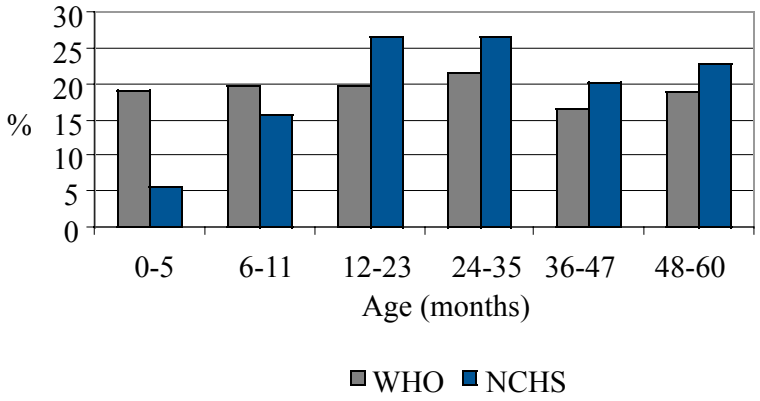
Haiti, 2005

Table 8.1: Anthropometric data by reference (WHO vs. NCHS), residence, infant sex, region, and age groups

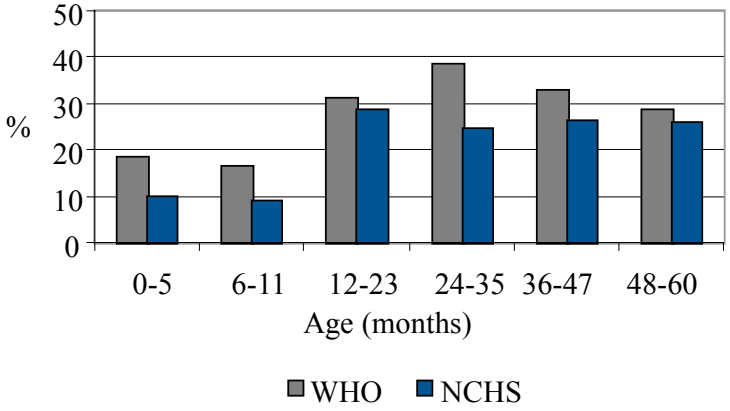
	Weight-for-age		Length/height-for-age		Weight-for-length/height			
	% <-3 SD	% < -2 SD	% < -3 SD	% < -2 SD	% < -3 SD	% < -2 SD	% >+2 SD	% >+3 SD
Reference								
WHO	7.37	19.21	10.61	30.13	3.26	10.34	4.14	16.11
NCHS	5.42	21.69	7.51	23.27	1.76	8.79	2.47	10.55
Residence								
Urban	4.65	14.17	6.02	20.42	2.48	8.21	4.19	18.00
Rural	8.72	21.72	12.87	34.93	3.65	11.40	4.11	15.17
Sex								
Male	8.77	20.66	12.87	33.58	3.02	10.29	4.54	15.80
Female	6.03	17.83	8.45	26.84	3.49	10.38	3.76	16.40
Region								
Metropolitan area	4.64	12.24	6.87	22.36	2.87	7.81	5.32	18.56
West	7.26	17.88	15.70	39.33	1.88	7.51	4.16	18.00
South-East	8.19	22.42	11.97	35.09	2.40	8.37	3.43	19.26
North	7.36	16.82	11.61	31.66	2.36	8.27	4.35	17.04
North-East	9.79	27.29	10.88	30.45	4.75	20.48	2.81	9.14
Artibonite	11.91	26.73	16.85	44.52	2.84	8.18	3.56	16.12
Centre	8.42	20.84	9.71	26.69	6.01	11.84	4.27	15.45
South	6.46	18.54	13.66	32.93	1.48	7.71	6.29	15.48
Grande-Anse	5.97	17.24	9.81	28.13	3.50	8.27	2.13	12.23
North-West	7.20	21.00	10.73	32.20	3.83	11.80	3.78	22.66
Age (WHO)								
0-5 mo	7.57	19.10	9.29	18.56	2.10	12.15	10.41	27.56
6-11 mo	11.23	19.69	6.89	16.57	5.72	15.63	5.55	19.94
12-23 mo	8.66	19.62	9.49	31.27	3.56	11.83	4.36	14.77
24-35 mo	6.94	21.63	13.70	38.37	2.33	9.85	2.80	15.78
36-47 mo	6.11	16.35	11.19	32.97	4.08	9.17	3.98	16.47
48-60 mo	5.90	18.91	10.16	28.86	2.53	7.37	2.12	10.74
Age (NCHS)								
0-5 mo	1.21	5.59	3.31	9.90	1.73	5.56	9.01	28.21
6-11 mo	5.69	15.63	3.39	9.12	3.94	8.94	5.11	19.12
12-23 mo	6.97	26.66	7.14	28.60	1.88	13.10	2.46	9.26
24-35 mo	6.43	26.49	9.33	24.50	0.50	8.19	0.73	6.71
36-47 mo	5.28	20.17	7.92	26.20	1.82	8.37	2.00	9.25
48-60 mo	4.61	22.76	9.21	25.71	1.95	6.87	0.81	5.88

Figures 8.1-8.5: Comparison of the prevalence of underweight, stunting, wasting and overweight using the WHO Standard vs. the NCHS reference, overall and by age group

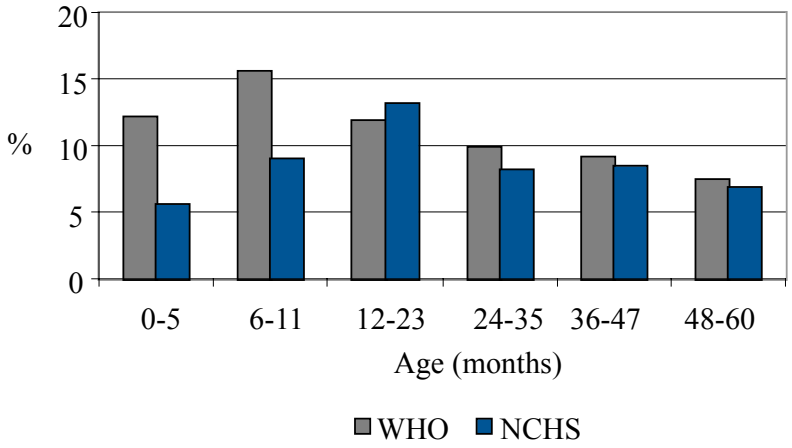
8.1 Haiti, 2005: Comparison of prevalence of underweight using the WHO standard vs. NCHS reference



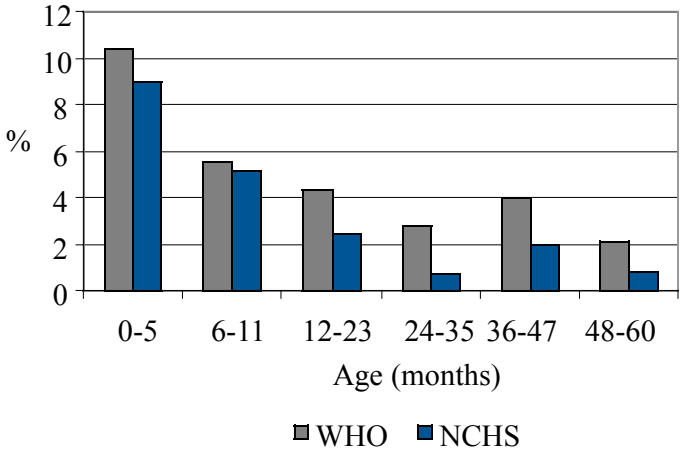
8.2 Haiti, 2005: Comparison of prevalence of stunting using the WHO standard vs. NCHS reference



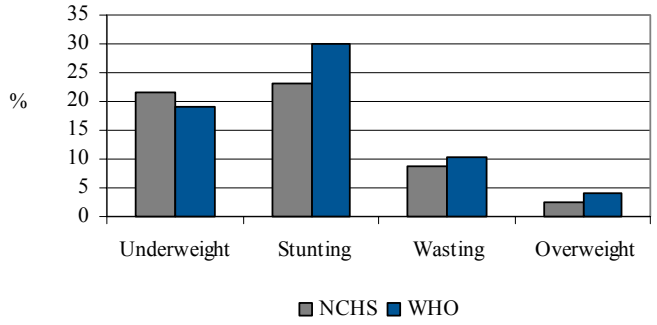
8.3 Haiti, 2005: Comparison of the prevalence of wasting using the WHO standard vs. NCHS reference



8.4 Haiti, 2005: Comparison of the prevalence of overweight using the WHO standard vs. NCHS reference

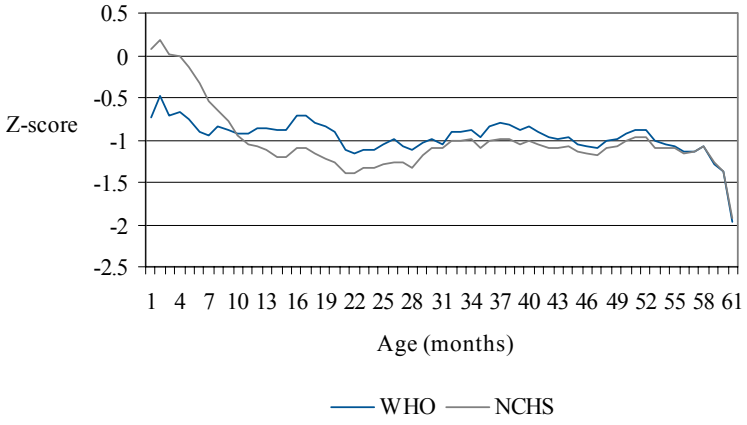


8.5 Haiti, 2005: Comparison of the prevalence of underweight, stunting, wasting and overweight using the WHO Standard vs. NCHS reference

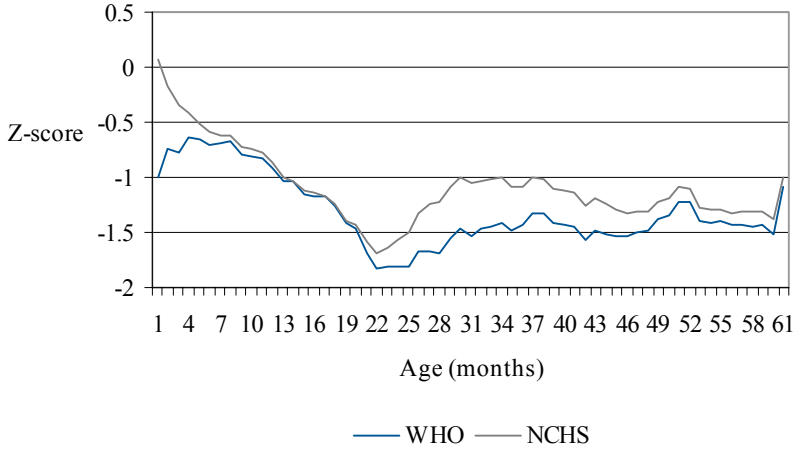


Figures 8.6-8.8: Comparison of five-month moving average Z-scores at each age using the WHO Standard vs. the NCHS reference

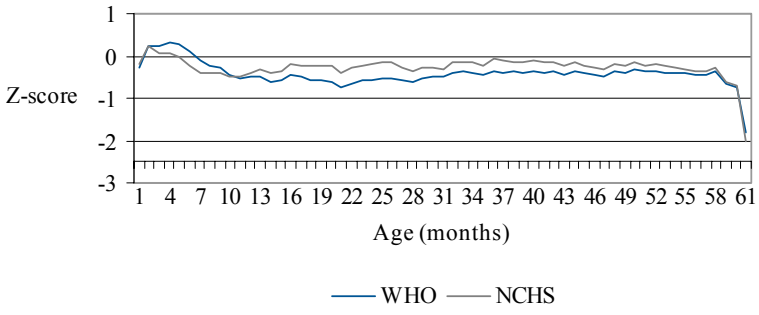
8.6 Haiti, 2005: Moving average weight-for-age Z-score using the WHO Standard vs. NCHS reference



8.7 Haiti, 2005: Moving average length/height-for-age Z-score using the WHO Standard vs. NCHS reference

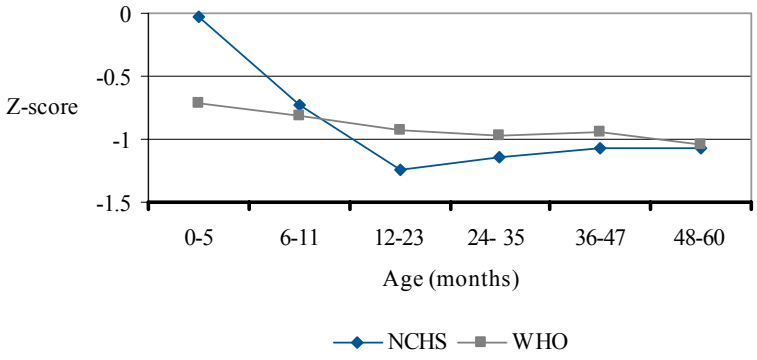


8.8 Haiti, 2005: Moving average weight-for-length/height Z-score using the WHO Standard vs. NCHS reference

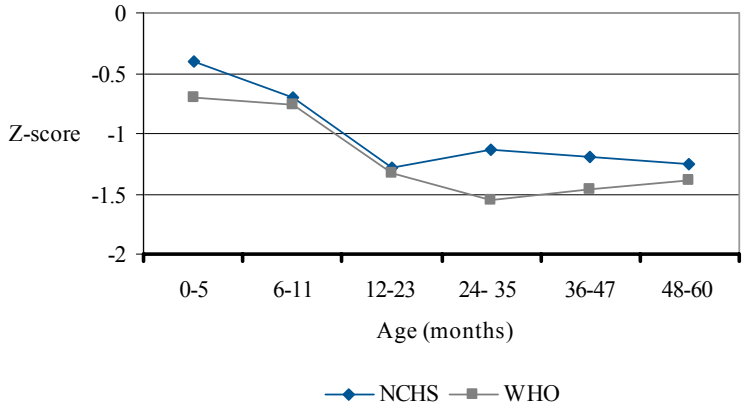


Figures 8.9-8.11: Comparison of mean Z-scores by age group using the WHO Standard vs. the NCHS reference

8.9 Haiti, 2005: Comparison of mean weight-for-age Z-score by age group using the WHO Standard vs. NCHS reference



8.10 Haiti, 2005: Comparison of mean length/height-for-age Z-score by age group using the WHO Standard vs. NCHS reference



8.11 Haiti, 2005: Comparison of mean weight-for-length/height Z-score by age group using the WHO Standard vs. NCHS reference

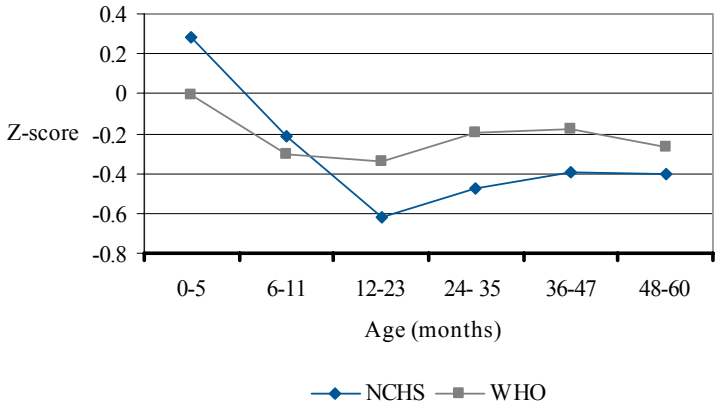


Figure 8.12: Five-month moving average for all anthropometric indicators using the WHO Standard, Haiti, 2005.

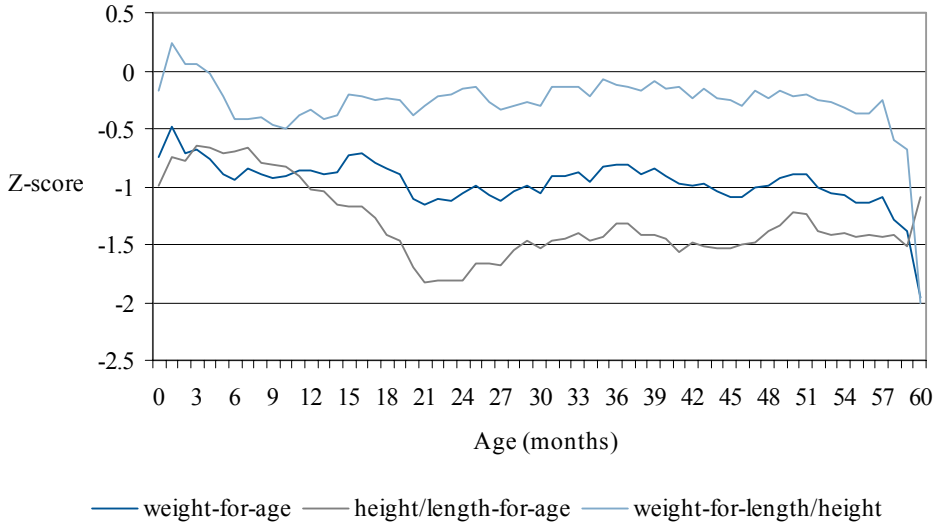
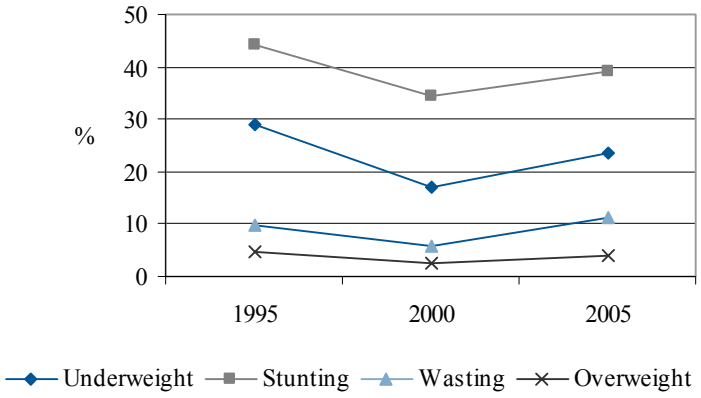
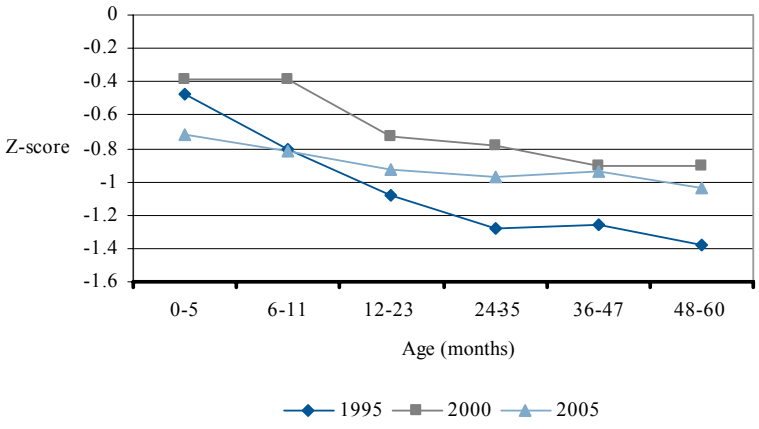


Figure 8.13: Trends in prevalence of all anthropometric indicators for children under five, Haiti, 1995-2005.

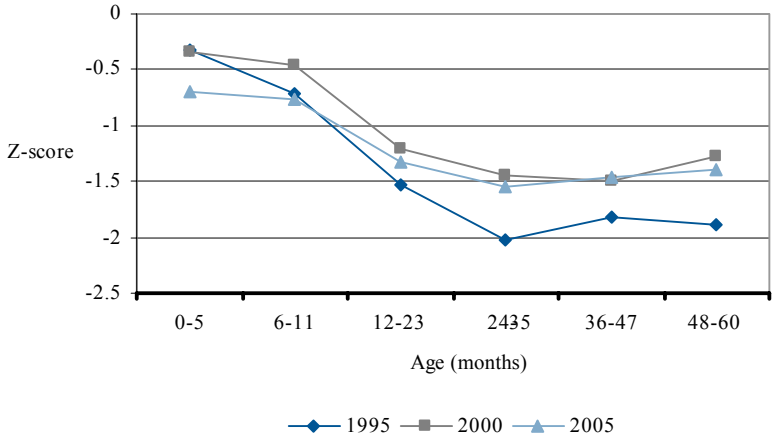


Figures 8.14-8.16: Trends in mean Z-scores by age groups, 1995-2005

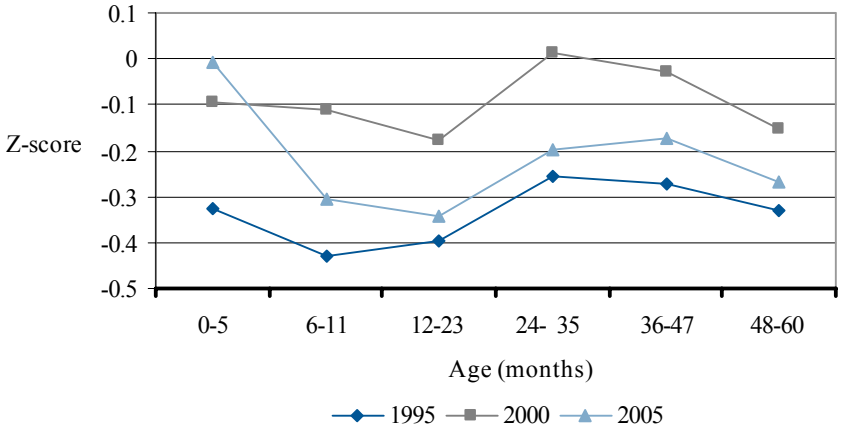
8.14 Haiti: Trends in mean weight-for-age Z-score by age group and survey year



8.15 Haiti: Trends in the mean length/height-for-age Z-score by age group and survey year

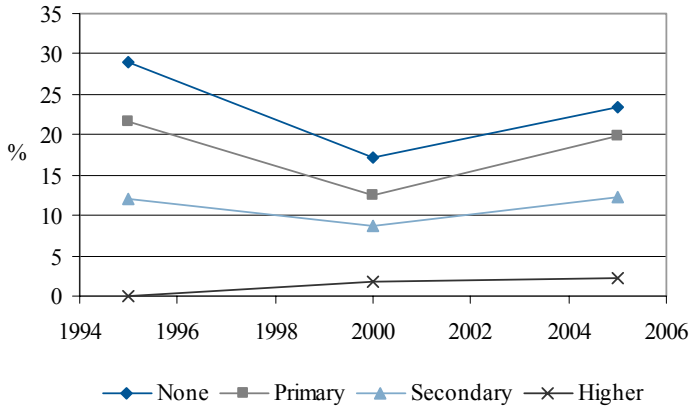


8.16 Haiti: Trends in the mean weight-for-length/height Z-score by age group and survey year

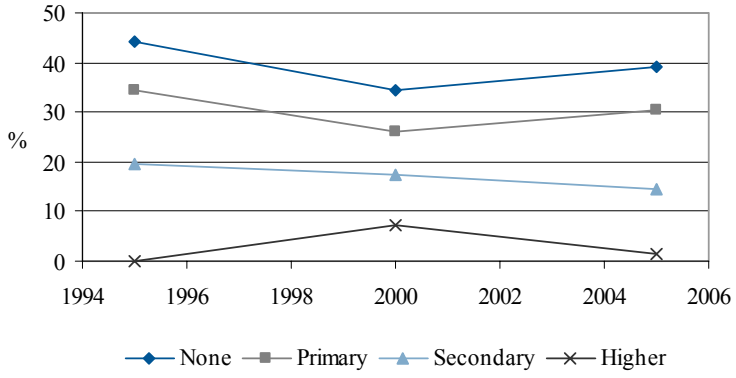


Figures 8.17-8.20: Trends in the prevalence of all anthropometric indicators by highest level of maternal education attained, 1995-2005

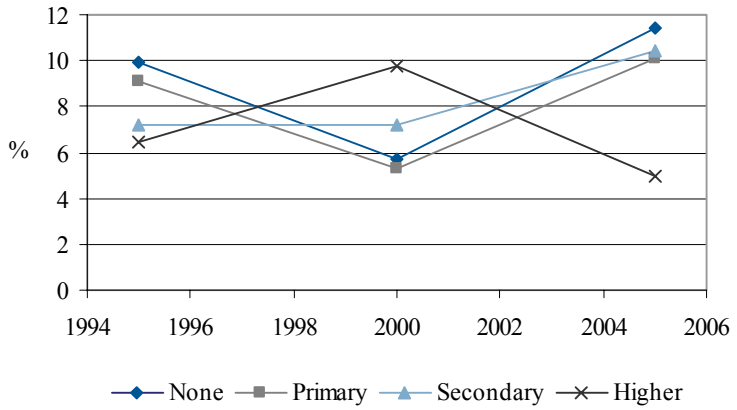
8.17 Haiti: Prevalence of underweight by survey year and highest level of maternal education attained



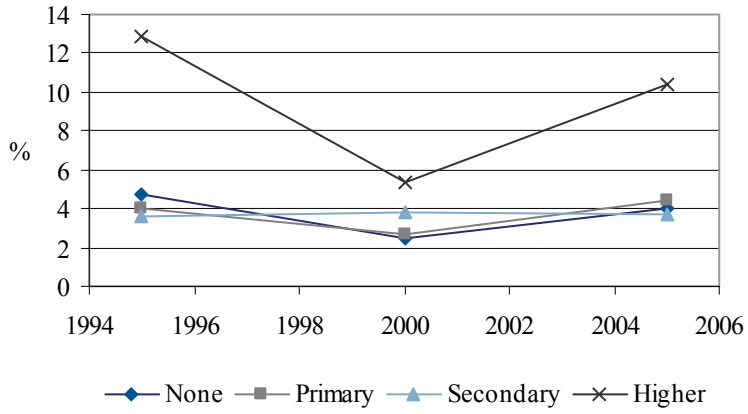
8.18 Haiti: Prevalence of stunting by survey year and highest level of maternal education attained



8.19 Haiti: Prevalence of wasting by survey year and highest level of maternal education attained



8.20 Haiti: Prevalence of overweight by survey year and highest level of maternal education attained



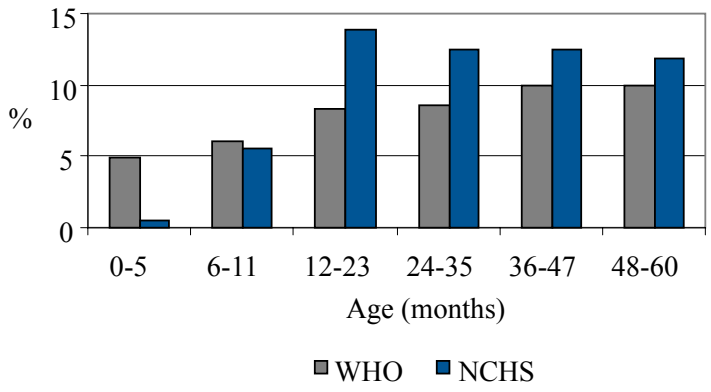
Appendix 9
Honduras, 2005

Table 9.1: Anthropometric data by reference (WHO vs. NCHS), residence, infant sex, region, and age groups

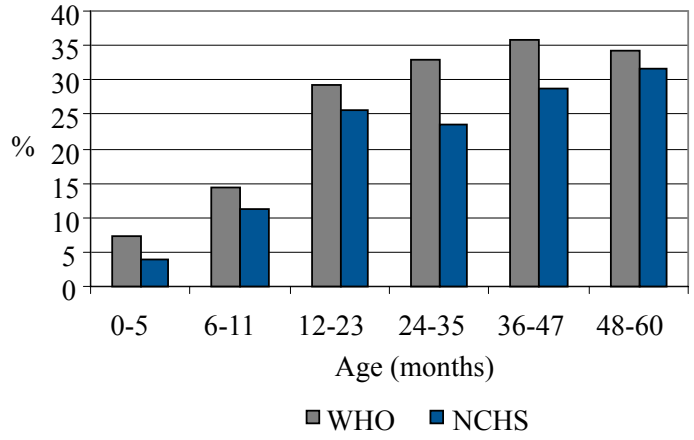
	Weight-for-age		Length/height-for-age		Weight-for-length/height			
	% <-3 SD	% < -2 SD	% < -3 SD	% < -2 SD	% < -3 SD	% < -2 SD	% >+2 SD	% >+3 SD
Reference								
NCHS	1.36	11.43	7.12	24.92	0.13	1.08	4.05	15.52
WHO	1.64	8.72	9.76	30.15	0.33	1.38	5.90	24.78
Residence								
Urban	1.02	4.95	4.48	17.75	0.17	1.04	8.12	29.03
Rural	2.05	11.25	13.32	38.51	0.43	1.60	4.41	21.93
Sex								
Male	1.73	8.97	10.70	31.65	0.39	1.63	6.38	25.43
Female	1.54	8.45	8.78	28.58	0.26	1.12	5.39	24.11
Region								
Atlantida	1.88	5.38	5.94	23.01	0.28	1.21	7.82	30.76
Colon	0.69	6.87	7.04	26.71	0.00	0.77	6.21	23.67
Comayagua	0.96	7.70	10.34	35.13	0.60	1.07	8.13	28.94
Copan	2.69	13.02	20.48	46.83	0.32	2.05	4.20	23.38
Cortes	0.74	4.60	4.40	19.49	0.41	1.72	6.02	27.04
Choluteca	2.88	10.98	8.68	30.38	0.47	2.67	4.43	19.08
El Paraiso	1.60	10.25	11.76	33.82	0.73	1.66	4.62	20.10
Francisco Morazan	1.39	5.12	4.14	18.61	0.13	0.66	7.74	29.21
Intibuca	4.00	16.74	23.09	53.81	0.21	1.34	3.50	20.05
La Paz	1.50	13.30	20.18	50.67	0.68	1.37	5.39	25.04
Lempira	4.74	20.35	26.59	54.93	0.66	2.31	2.60	18.28
Ocotepeque	2.93	17.15	16.80	48.02	0.55	2.70	3.37	15.55
Olancho	1.20	8.69	8.78	30.64	0.15	1.96	7.26	24.91
Santa Barbara	1.41	9.73	11.25	33.70	0.14	0.86	3.60	21.52
Valle	0.69	8.35	2.98	22.36	0.18	1.21	4.64	24.52
Yoro	1.20	8.30	8.43	26.70	0.10	0.10	6.82	23.72
Age (WHO)								
0-5 mo	2.05	4.96	1.75	7.41	0.44	4.58	8.26	28.96
6-11 mo	1.00	6.01	3.27	14.44	0.56	3.05	7.54	27.48
12-23 mo	1.78	8.36	10.08	29.29	0.37	1.45	6.54	26.73
24-35 mo	1.86	8.57	11.09	32.84	0.43	1.39	6.04	24.84
36-47 mo	1.70	9.92	12.44	35.76	0.25	0.65	5.44	24.17
48-60 mo	1.52	9.91	10.14	34.20	0.13	0.71	4.49	21.70
Age (NCHS)								
0-5 mo	0.22	0.55	0.47	3.88	0.22	0.56	11.26	35.40
6-11 mo	0.62	5.55	1.64	11.11	0.36	1.74	6.93	24.84
12-23 mo	1.93	13.80	6.92	25.74	0.15	1.68	4.60	15.72
24-35 mo	2.19	12.52	6.60	23.50	0.18	1.29	2.51	11.18
36-47 mo	1.30	12.51	9.20	28.83	0.05	0.67	3.05	12.72
48-60 mo	0.69	11.81	9.48	31.62	0.04	0.49	3.42	14.40

Figures 9.1-9.4: Comparison of the prevalence of underweight, stunting, wasting and overweight using the WHO Standard vs. the NCHS reference, overall and by age group

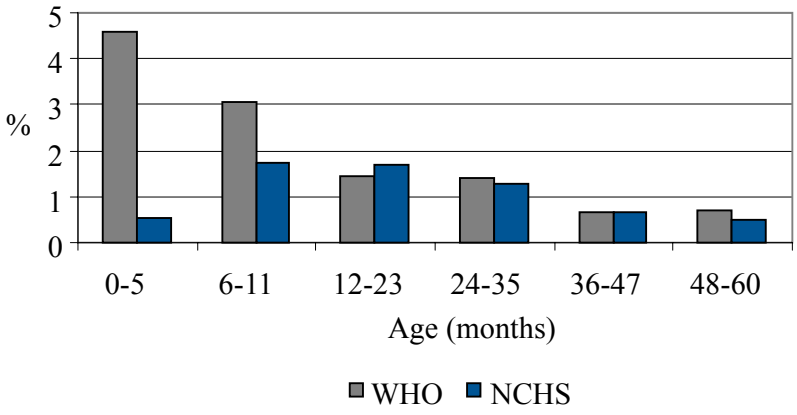
9.1 Honduras, 2005: Comparison of prevalence of underweight using the WHO standard vs. NCHS reference



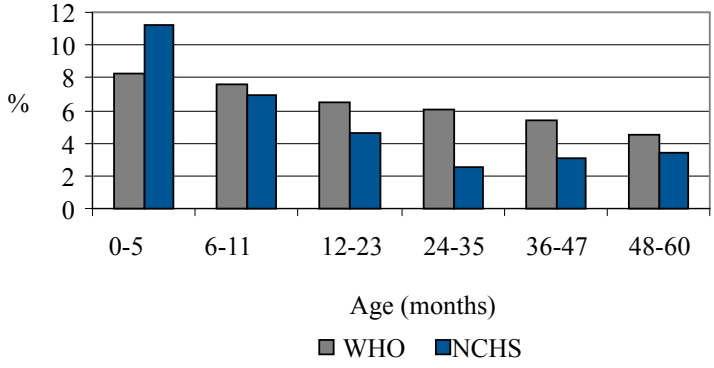
9.2 Honduras, 2005: Comparison of prevalence of stunting using the WHO Standard vs. NCHS reference



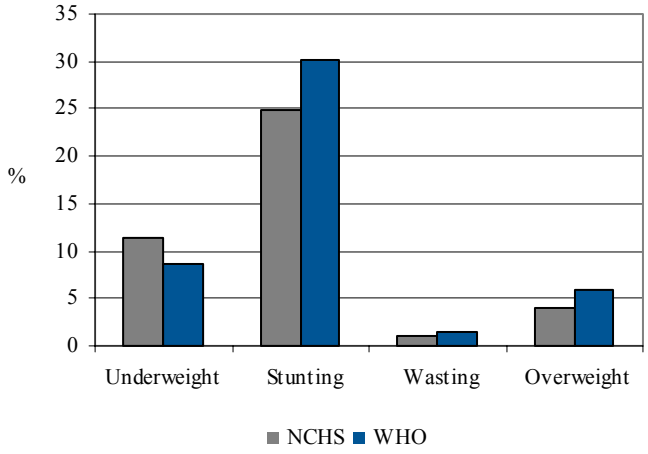
9.3 Honduras, 2005: Comparison of prevalence of wasting using the WHO Standard vs. NCHS reference



9.4 Honduras, 2005: Comparison of prevalence of overweight using the WHO Standard vs. NCHS reference

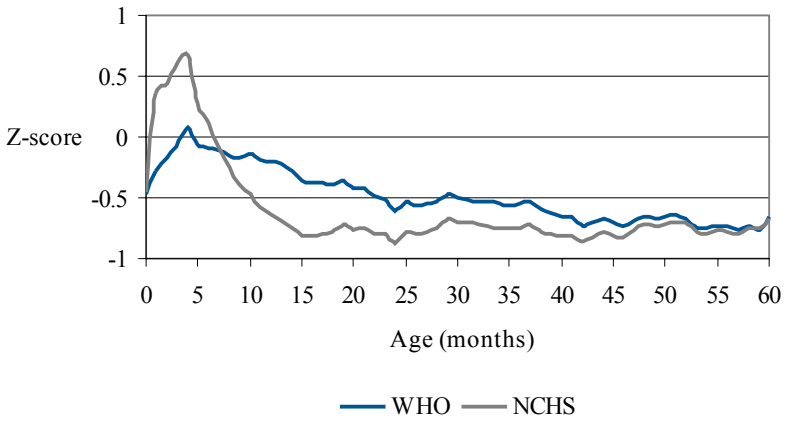


9.5 Honduras, 2005: Comparison of the prevalence of underweight, stunting, wasting and overweight using the WHO Standard vs. NCHS reference

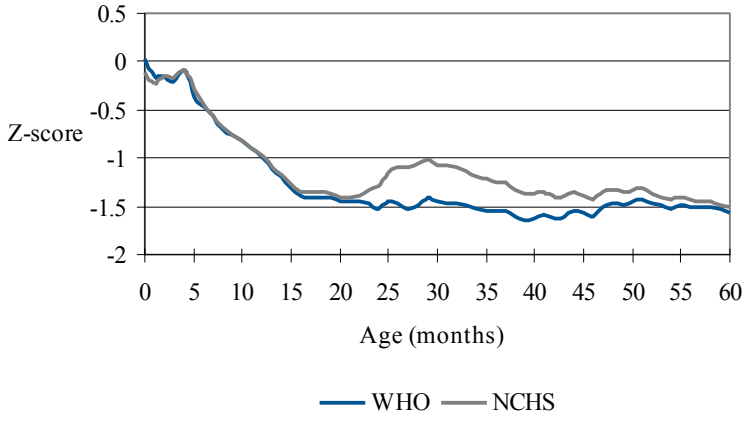


Figures 9.6-9.8: Comparison of five-month moving average Z-scores at each age using the WHO Standard vs. the NCHS reference

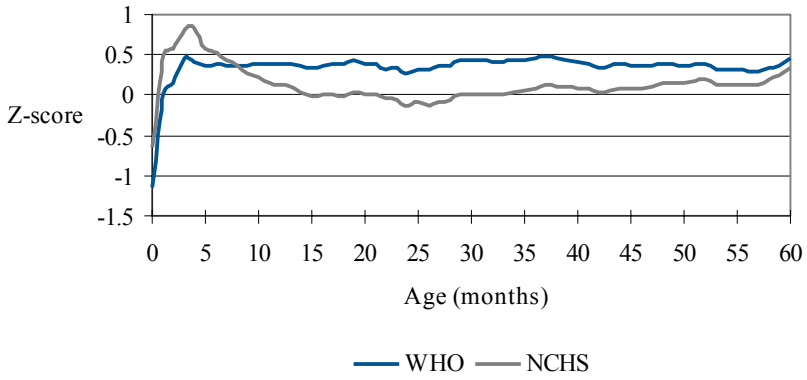
9.6 Honduras, 2005: Moving average weight-for-age Z-score using the WHO Standard vs. NCHS reference



9.7 Honduras, 2005: Moving average length/height-for-age Z-score using the WHO Standard vs. NCHS reference

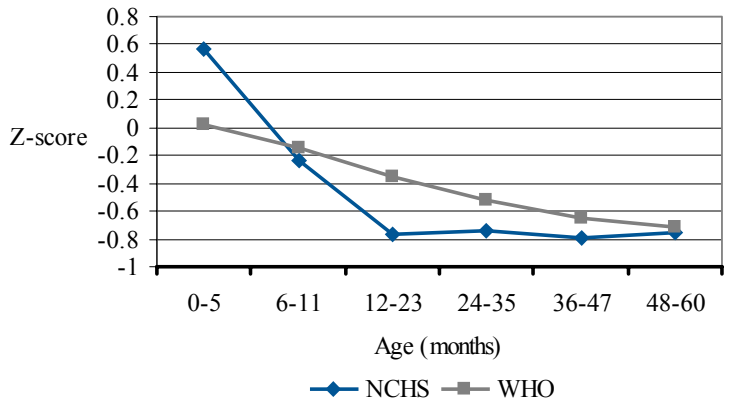


9.8 Honduras, 2005: Moving average weight-for-length/height Z-score using the WHO Standard vs. NCHS reference

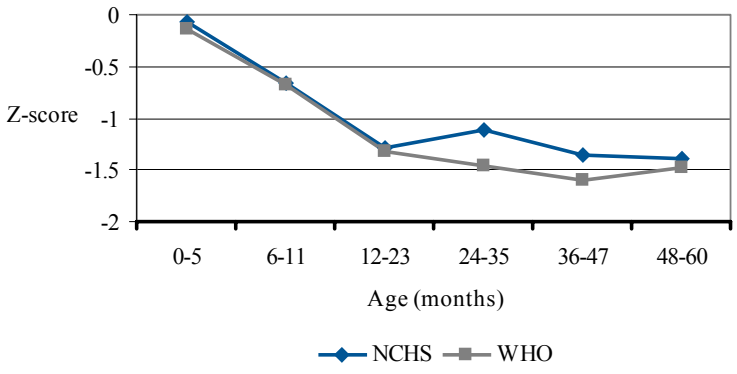


Figures 9.9-9.11: Comparison of mean Z-scores by age group using the WHO Standard vs. the NCHS reference

9.9 Honduras, 2005: Comparison of mean weight-for-age Z-score by age group using the WHO Standard vs. NCHS reference



9.10 Honduras, 2005: Comparison of mean length/height-for-age Z-score by age group using the WHO Standard vs. NCHS reference



9.11 Honduras, 2005: Comparison of mean weight-for-length/height Z-score by age group using the WHO Standard vs. NCHS reference

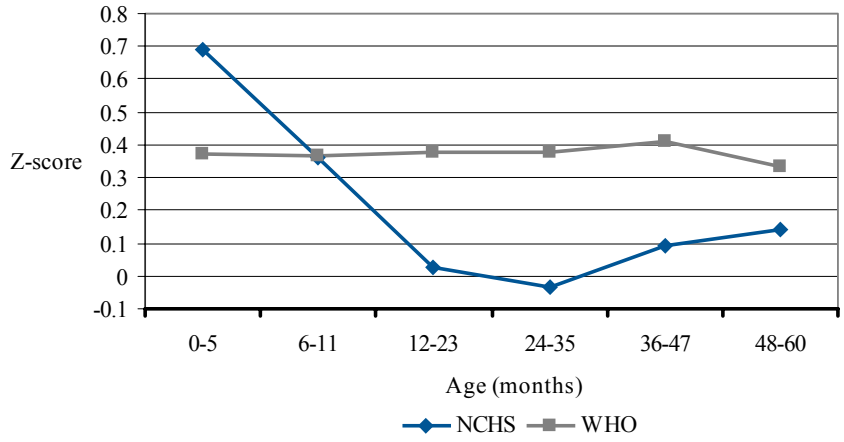


Figure 9.12: Five-month moving average for all anthropometric indicators using the WHO Standard, Honduras, 2005.

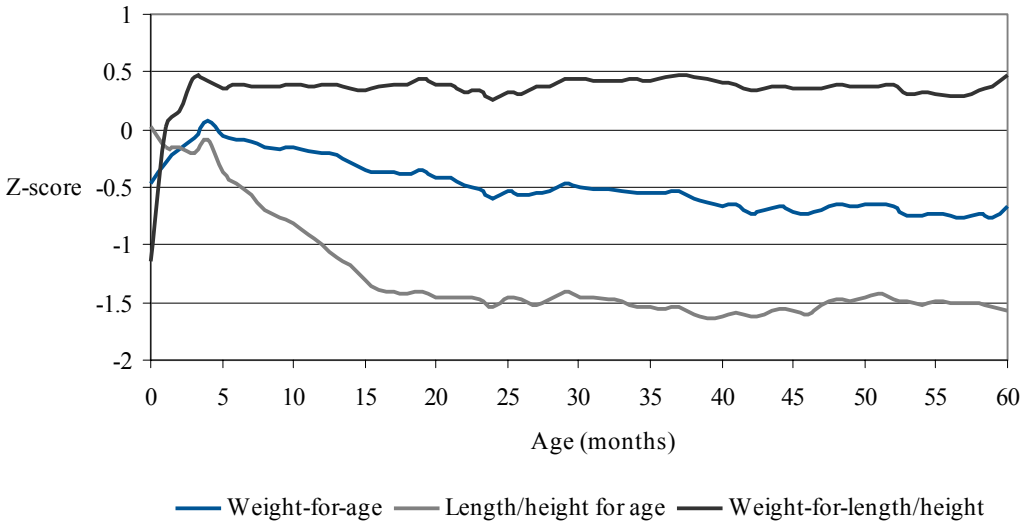
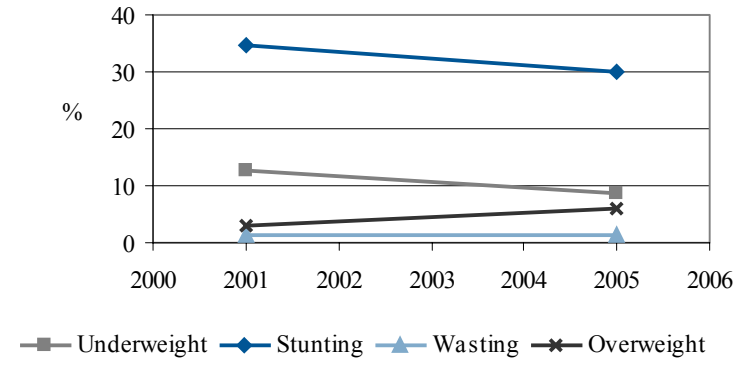
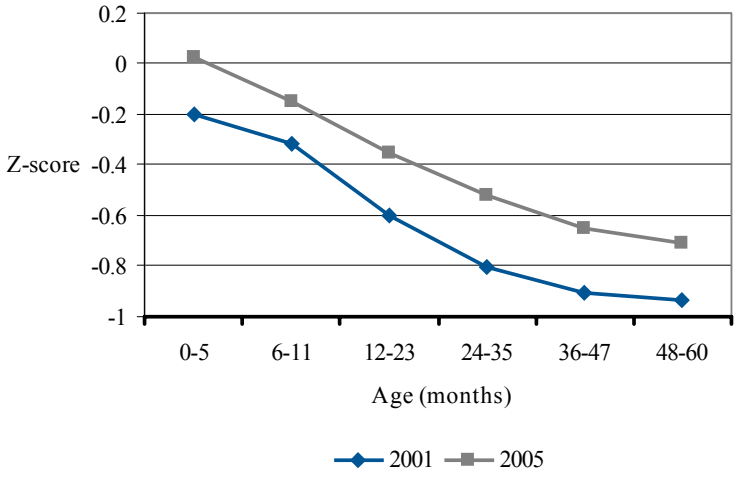


Figure 9.13: Trends in prevalence of all anthropometric indicators for children under five, Honduras, 2001-2005.

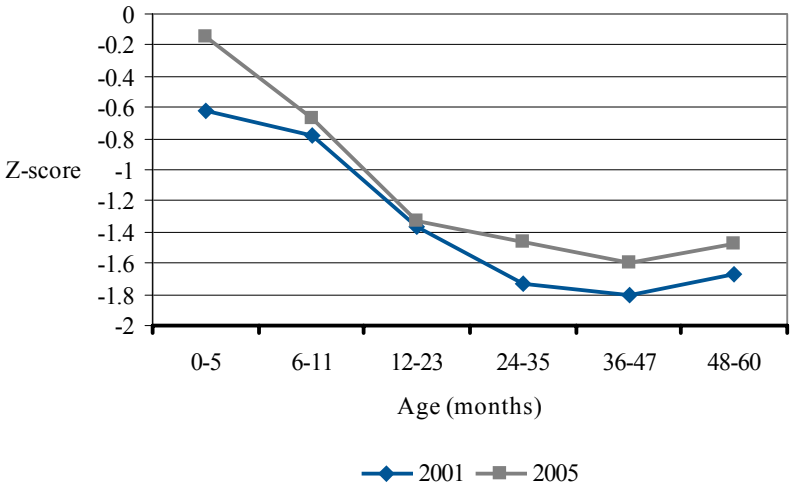


Figures 9.14-9.16: Trends in mean Z-scores by age groups, 2001-2005

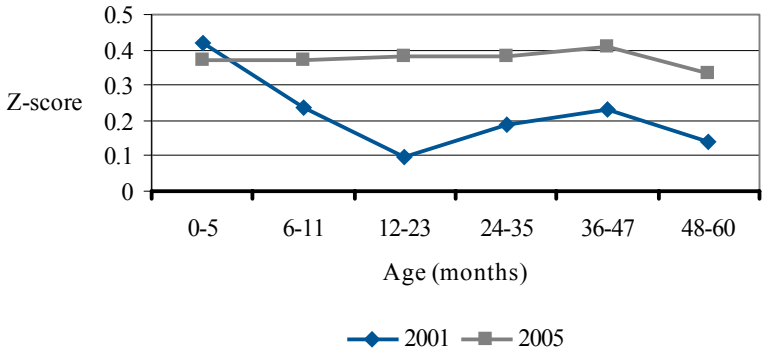
9.14 Honduras: Trends in mean weight-for-age Z-score by age group and survey year



9.15 Honduras: Trends in the mean length/height-for-age Z-score by age group and survey year

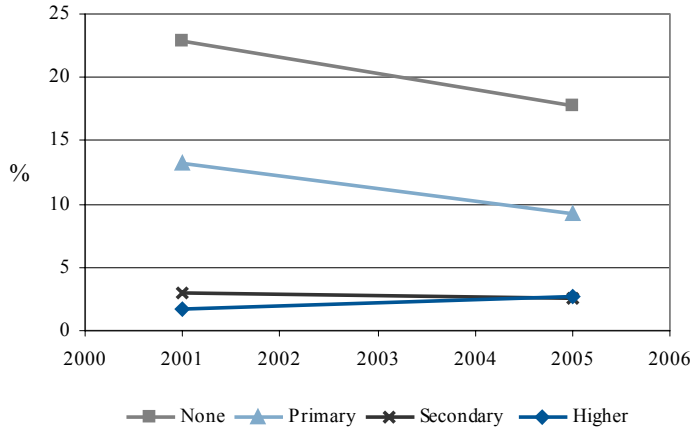


9.16 Honduras: Trends in the mean weight-for-length/height Z-score by age group and survey year

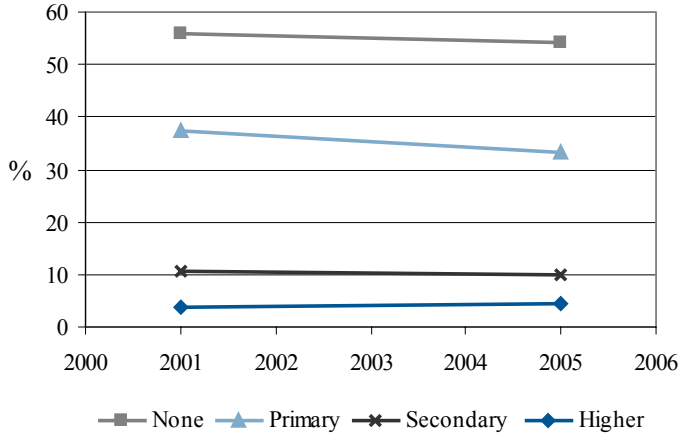


Figures 9.17-9.20: Trends in the prevalence of all anthropometric indicators by highest level of maternal education attained, 2001-2005

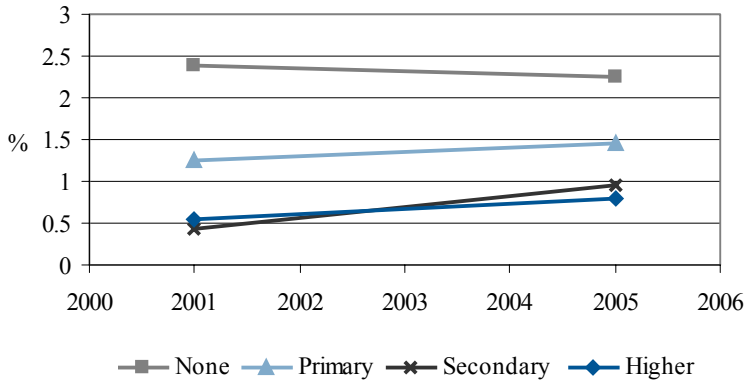
9.17 Honduras: Prevalence of underweight by survey year and highest level of maternal education attained



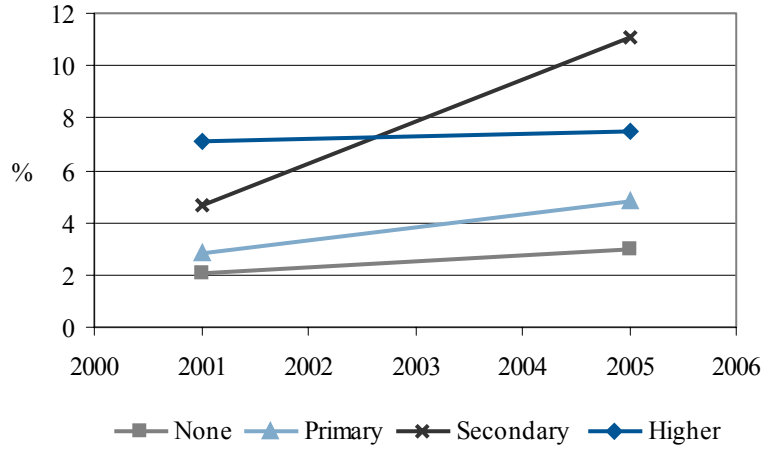
9.18 Honduras: Prevalence of stunting by survey year and highest level of maternal education attained



9.19 Honduras: Prevalence of wasting by survey year and highest level of maternal education attained



9.20 Honduras: Prevalence of overweight by survey year and highest level of maternal education attained



Appendix 10

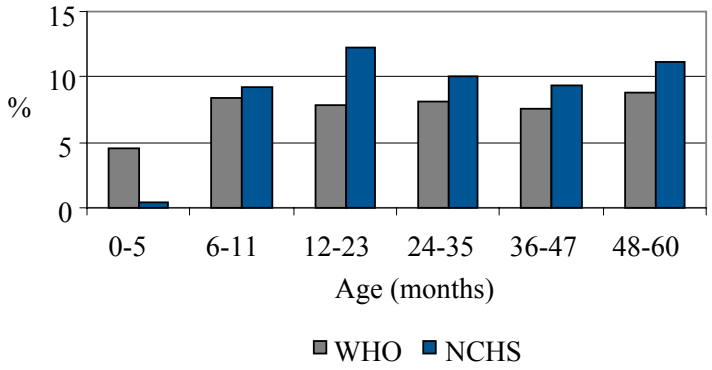
Nicaragua, 2001

Table 10.1: Anthropometric data by reference (WHO vs. NCHS), residence, infant sex, region, and age groups

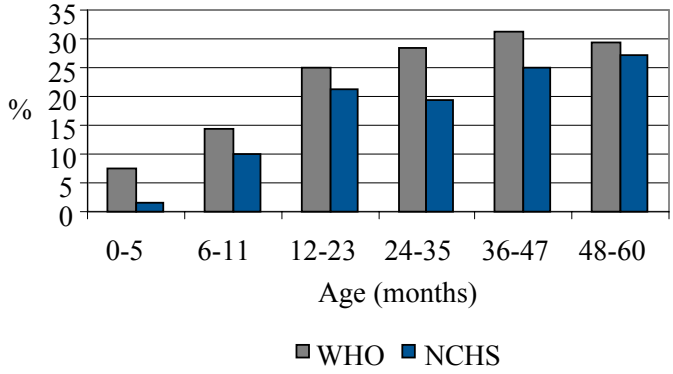
	Weight-for-age		Length/height-for-age		Weight-for-length/height			
	% <-3 SD	% < -2 SD	% < -3 SD	% < -2 SD	% < -3 SD	% < -2 SD	% >+2 SD	% >+3 SD
Reference								
WHO	2.11	7.83	9.04	25.37	0.89	2.33	7.29	2.45
NCHS	1.61	9.75	6.18	20.18	0.29	1.96	4.82	1.96
Residence								
Urban	1.21	5.15	4.09	14.92	0.50	1.53	6.91	2.30
Rural	3.01	10.48	14.02	35.89	1.27	3.13	7.67	2.59
Sex								
Male	2.14	8.49	9.70	27.11	1.13	2.71	8.32	2.54
Female	2.08	7.13	8.36	23.57	0.64	1.94	6.22	2.35
Region								
Nueva Segovia	1.86	7.14	7.79	26.48	0.63	2.53	5.38	1.27
Jinotega	4.14	16.55	17.14	44.29	2.21	4.91	6.39	0.98
Madriz	5.06	13.39	14.67	42.22	0.92	3.36	4.59	0.61
Esteli	0.00	5.04	4.62	20.59	0.00	0.86	6.01	0.86
Chinandega	1.99	9.45	8.91	24.43	0.77	1.53	6.63	1.79
Leon	1.30	4.22	2.98	17.88	0.00	1.32	4.97	1.32
Matagalpa	3.57	9.87	16.74	38.04	1.35	3.59	12.78	6.95
Boaco	3.72	8.78	8.79	26.65	1.40	3.07	12.01	3.35
Managua	1.52	4.78	2.64	9.23	0.67	1.77	4.43	1.55
Masaya	1.03	5.84	6.94	23.26	0.35	1.05	8.77	1.40
Chontales	0.00	3.90	5.19	20.37	1.52	3.41	9.09	3.79
Granada	2.14	6.05	4.74	16.06	0.37	1.10	6.99	1.84
Carazo	0.00	3.32	7.85	19.42	0.84	1.69	13.50	4.64
Rivas	1.09	5.47	4.06	17.34	0.74	1.48	6.64	0.74
Rio San Juan	1.72	3.16	9.71	25.00	0.94	2.19	10.00	5.00
Atlantico Norte	2.65	11.50	18.68	39.56	0.72	2.53	6.51	2.17
Atlantico Sur	1.79	6.76	9.64	31.33	1.22	2.24	9.59	4.49
Age (WHO)								28.96
0-5 mo	1.09	4.56	1.84	7.54	2.91	4.91	6.60	2.43
6-11 mo	4.04	8.37	6.17	14.24	1.75	3.93	7.27	1.60
12-23 mo	2.15	7.89	6.98	25.14	0.87	3.46	7.07	2.02
24-35 mo	1.76	8.06	11.55	28.40	0.53	1.20	7.30	1.87
36-47 mo	2.02	7.57	11.26	31.14	0.67	0.96	8.40	3.46
48-60 mo	2.06	8.87	10.82	29.37	0.25	1.83	6.69	2.88
Age (NCHS)								
0-5 mo	0.09	0.35	0.40	1.66	0.09	1.76	6.41	1.94
6-11 mo	1.82	9.27	2.91	9.98	0.51	1.92	6.51	1.32
12-23 mo	2.26	12.25	4.65	21.10	0.64	4.31	4.30	1.35
24-35 mo	1.78	10.05	7.16	19.50	0.19	1.33	2.84	1.22
36-47 mo	1.32	9.33	7.26	24.87	0.18	0.70	4.84	2.86
48-60 mo	1.58	11.21	9.53	27.34	0.10	1.46	6.02	2.77

Figures 10.1-10.5: Comparison of the prevalence of underweight, stunting, wasting and overweight using the WHO Standard vs. the NCHS reference, overall and by age group

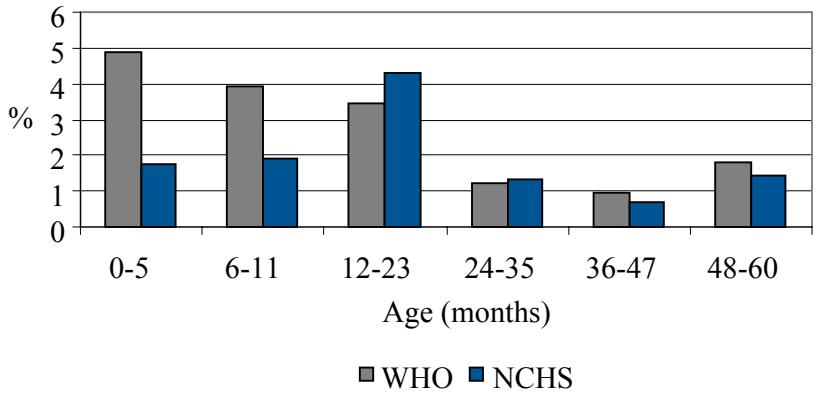
10.1 Nicaragua, 2001: Comparison of the prevalence of underweight using the WHO Standard vs. NCHS reference



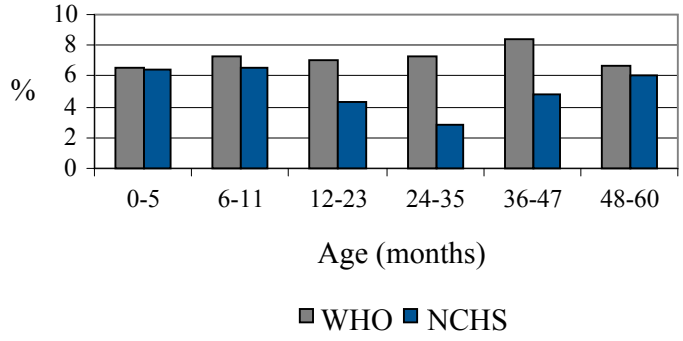
10.2 Nicaragua, 2001: Comparison of the prevalence of stunting using the WHO Standard vs. NCHS reference



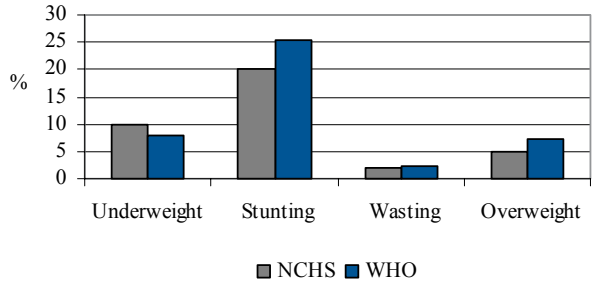
10.3 Nicaragua, 2001: Comparison of the prevalence of wasting using the WHO Standard vs. NCHS reference



10.4 Nicaragua, 2001: Comparison of the prevalence of overweight using the WHO Standard vs. NCHS reference

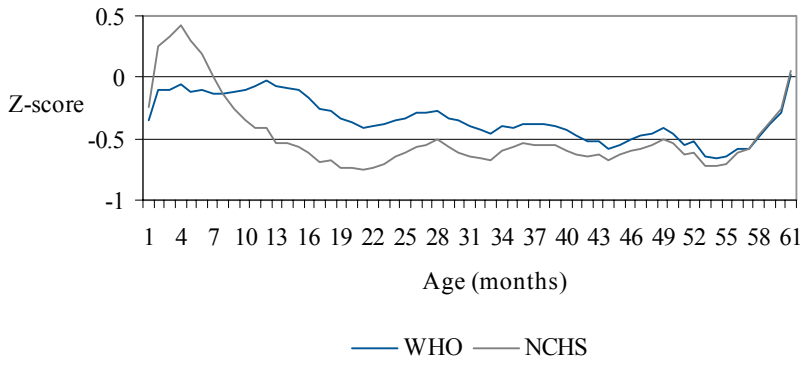


10.5 Nicaragua, 2001: Comparison of prevalence of underweight, stunting, wasting and overweight using the WHO Standard vs. NCHS reference

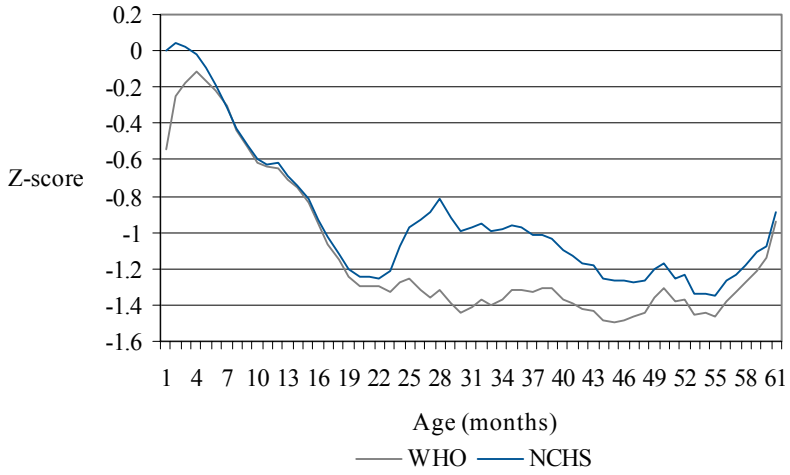


Figures 10.6-10.8: Comparison of five-month moving average Z-scores at each age using the WHO Standard vs. the NCHS reference

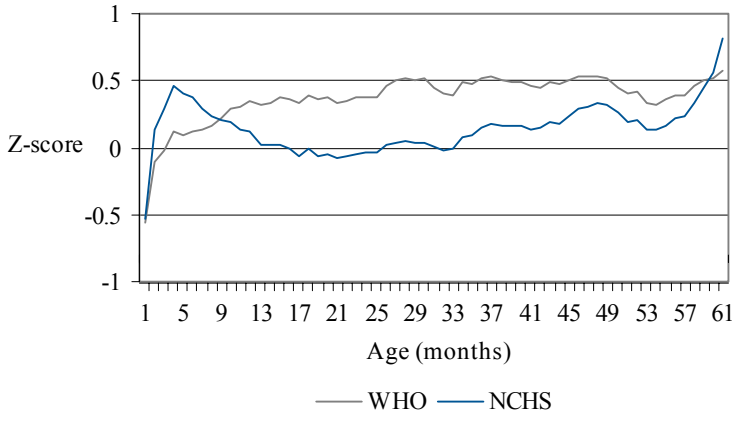
10.6 Nicaragua, 2001: Moving average weight-for-age Z-score using the WHO Standard vs. NCHS reference



10.7 Nicaragua, 2001: Moving average length/height-for-age using the WHO Standard vs. NCHS reference

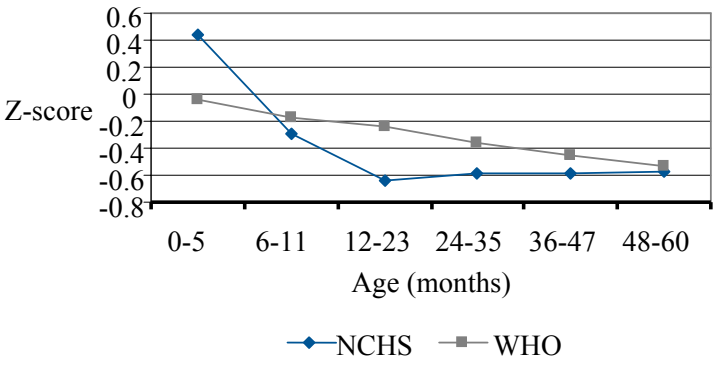


10.8 Nicaragua, 2001: Moving average weight-for-length/height Z-score using the WHO Standard vs. NCHS reference

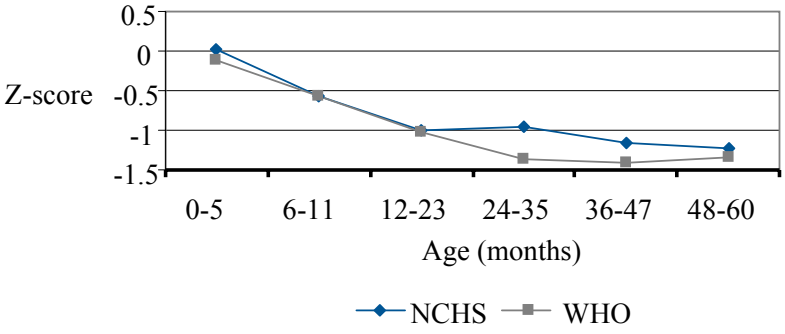


Figures 10.9-10.11: Comparison of mean Z-scores by age group using the WHO Standard vs. the NCHS reference

10.9 Nicaragua, 2001: Comparison of mean weight-for-age Z-score by age group using the WHO Standard vs. NCHS reference



10.10 Nicaragua, 2001: Comparison of the mean length/height-for-age Z-score by age group using the WHO Standard vs. NCHS reference



10.11 Nicaragua, 2001: Comparison of the mean weight-for-length/height by age group using the WHO Standard vs. NCHS reference

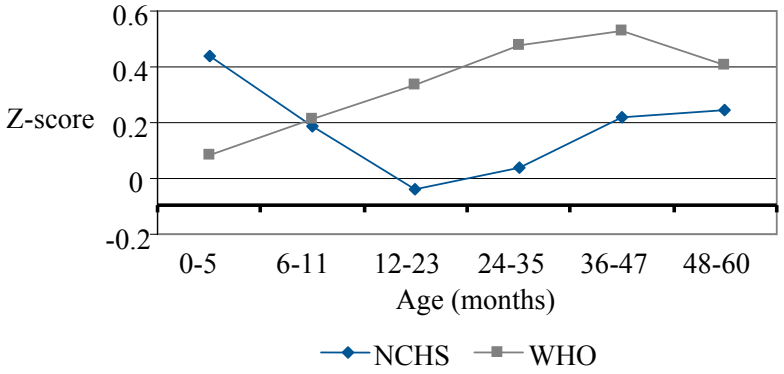


Figure 10.12: Five-month moving average for all anthropometric indicators using the WHO Standard.

Nicaragua, 2001: Five-month moving averages Z-scores for all anthropometric indicators using the WHO Standard

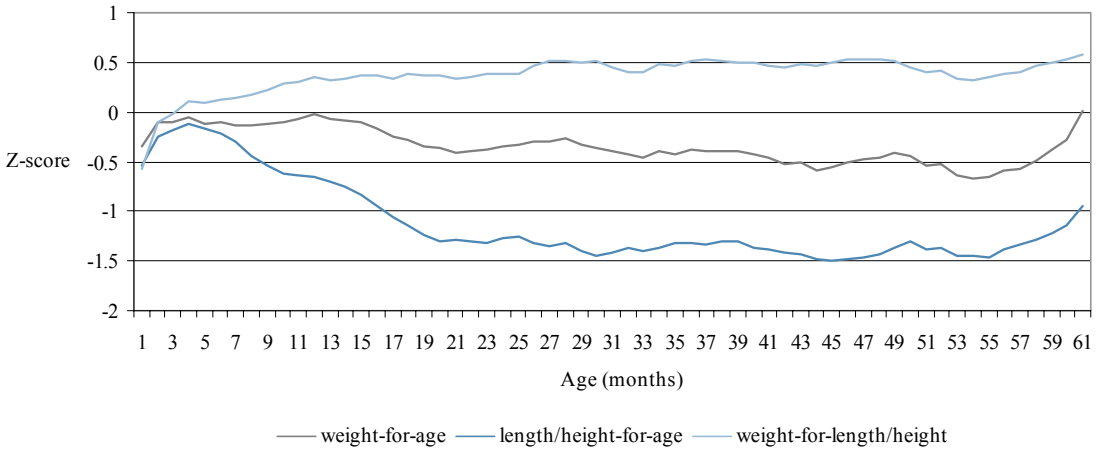
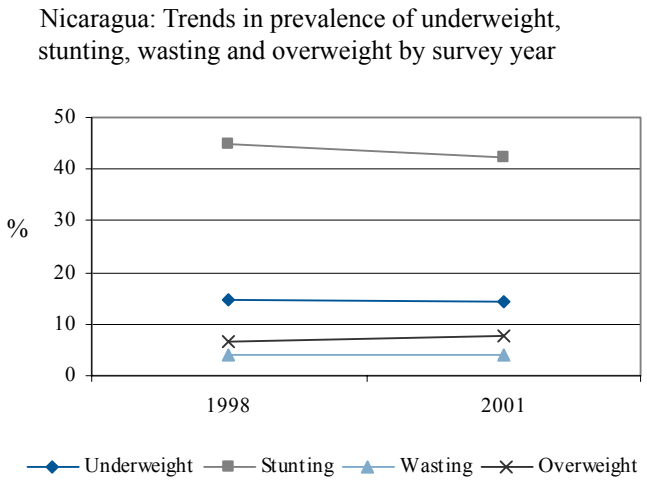
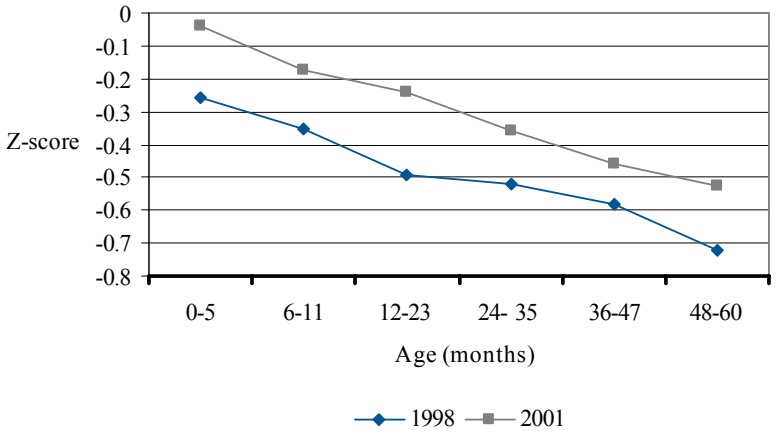


Figure 10.13: Trends in prevalence of all anthropometric indicators for children under five, 1998-2001

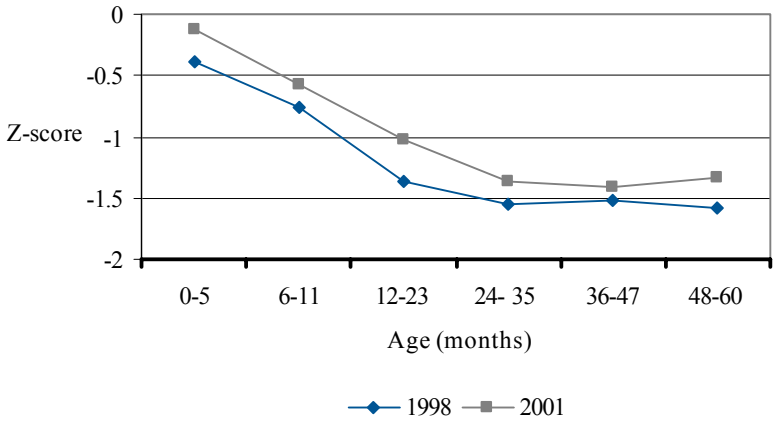


Figures 10.14-10.16: Trends in mean Z-scores by age groups, 1998-2001

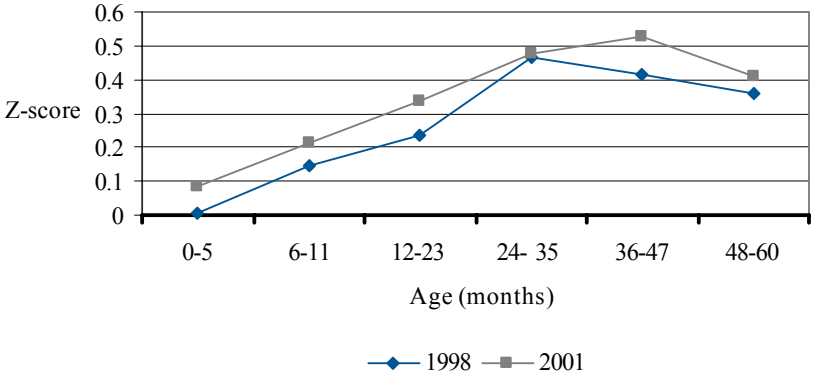
10.14 Nicaragua: Trends in mean weight-for-age Z-score by age group and survey year



10.15 Nicaragua: Trends in mean length/height-for-age Z-score by age group and survey year

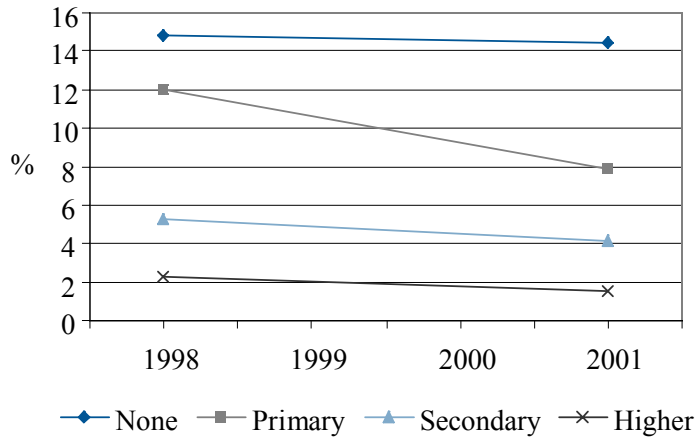


10.16 Nicaragua: Trends in mean weight-for-length/height Z-score by age group and survey year

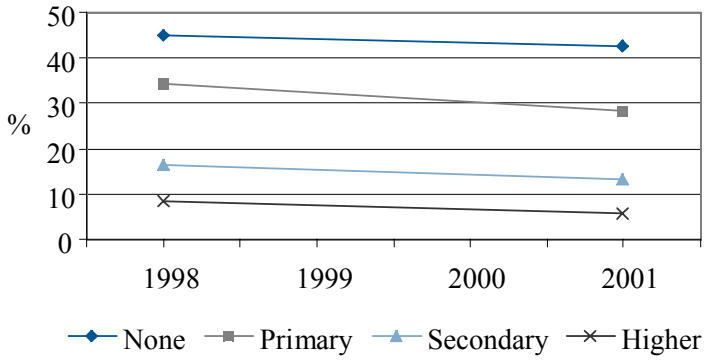


Figures 10.17-10.20: Trends in the prevalence of all anthropometric indicators by highest level of maternal education attained, 1998-2001

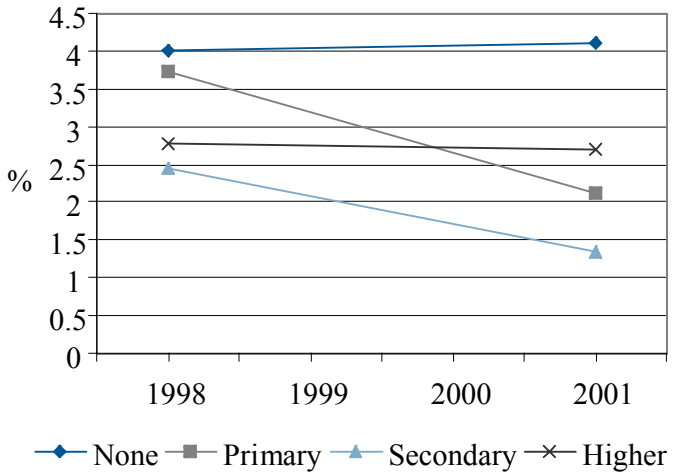
10.17 Nicaragua: Prevalence of underweight by survey year and highest level of maternal education attained



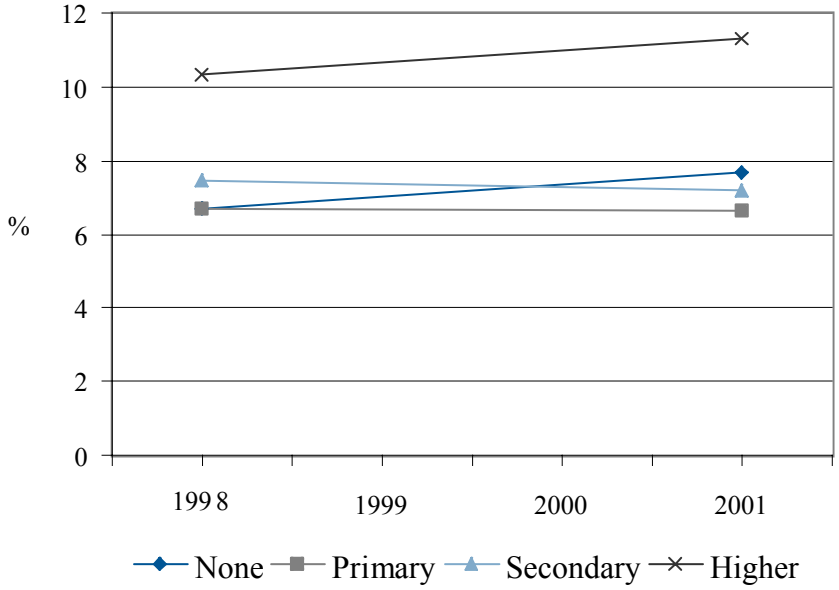
10.18 Nicaragua: Prevalence of stunting by survey year and highest level of maternal education attained



10.19 Nicaragua: Prevalence of wasting by survey year and highest level of maternal education attained



10.20 Nicaragua: Prevalence of overweight by survey year and highest level of maternal education attained



Appendix 11

Peru, 2004-2008

Table 11.1: Anthropometric data by reference (WHO vs. NCHS), residence, infant sex, region, and age groups

	Weight-for-age	Length/height-for-age	Weight-for-length/height	
	% < -2 SD	% < -2 SD	% < -2 SD	% >+2 SD
Reference				
WHO	5.62	29.83	1.16	8.80
NCHS	7.75	24.22	1.02	5.57
Residence				
Urban	2.33	13.02	1.00	11.00
Rural	9.05	47.40	1.33	6.51
Sex				
Male	6.15	33.45	1.31	10.54
Female	5.07	26.08	1.01	6.99
Region				
Amazonas	7.5	39.7	0.8	5.8
Ancash	5.3	39.7	0.7	9.9
Apurimac	5.5	43.7	0.7	7.9
Arequipa	3.3	12.0	0.3	11.3
Ayacucho	5.8	45.7	0.3	4.4
Cajamarca	6.8	45.8	0.3	10.6
Cusco	5.4	31.1	0.7	6.2
Hauncavelica	10.1	60.1	0.4	6.6
Huanuco	10.4	48.6	0.8	8.7
Ica	1.6	13.7	1.0	13.4
Junin	4.3	30.1	1.8	6.4
La Libertad	3.6	33.9	0.4	14.4
Lambayeque	4.2	20.0	0.8	6.8
Lima	2.0	11.7	1.5	14.4
Loreto	8.9	33.5	2.1	1.6
Madre de Dios	2.3	15.0	1.5	6.4
Moquegua	1.4	9.5	1.2	15.0
Pasco	7.6	39.6	1.6	9.1
Piura	8.6	29.9	1.5	6.6
Puno	1.9	39.5	0.8	10.3
San Martin	6.4	24.6	0.8	3.6
Tacna	1.1	6.7	0.4	21.9
Tumbes	3.5	13.2	0.4	12.7
Ucayali	5.8	32.7	1.1	2.8

Continue >

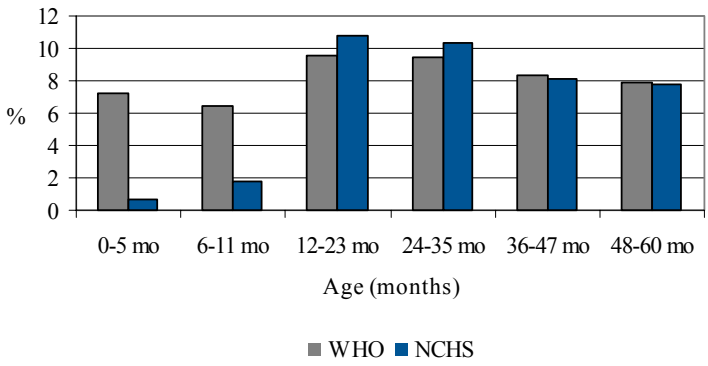
Continue Table 11.1: Anthropometric data by reference (WHO vs. NCHS), residence, infant sex, region, and age groups

	Weight-for-age	Length/height-for-age	Weight-for-length/height	
	% < -2 SD	% < -2 SD	% < -2 SD	% >+2 SD
Age (WHO)				
0-5 mo	3.90	13.01	2.94	19.33
6-11 mo	1.96	10.25	0.71	6.54
12-23 mo	5.78	32.10	0.90	9.56
24-35 mo	6.79	37.23	1.18	8.39
36-47 mo	6.29	34.46	1.44	6.07
48-60 mo	6.41	34.28	0.60	7.44
Age (NCHS)				
0-5 mo	0.62	3.65	0.00	17.35
6-11 mo	1.75	7.44	2.02	6.04
12-23 mo	10.98	29.24	0.75	6.16
24-35 mo	10.33	25.83	1.29	2.28
36-47 mo	8.27	27.59	1.44	2.43
48-60 mo	7.71	31.53	0.60	5.55

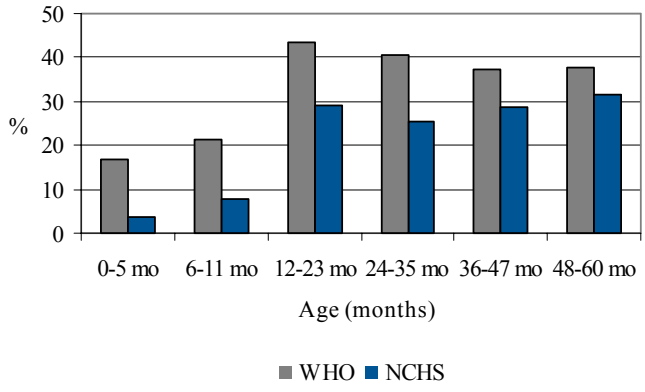
1 National-level data were calculated from the first round of data collection in 2005; regional-level data were calculated from the rounds of data collection completed in 2005, 2007 and the first trimester of 2008.

Figures 11.1-11.5: Comparison of the prevalence of underweight, stunting, wasting and overweight using the WHO Standard vs. the NCHS reference, overall and by age group

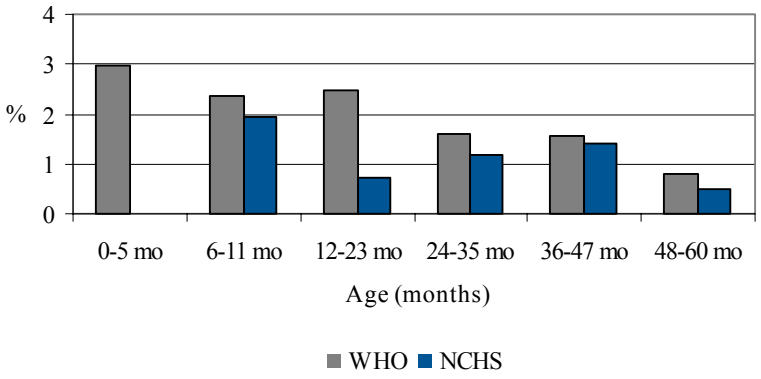
11.1 Peru, 2004-2008: Comparison of the prevalence of underweight using the WHO Standard vs. NCHS reference



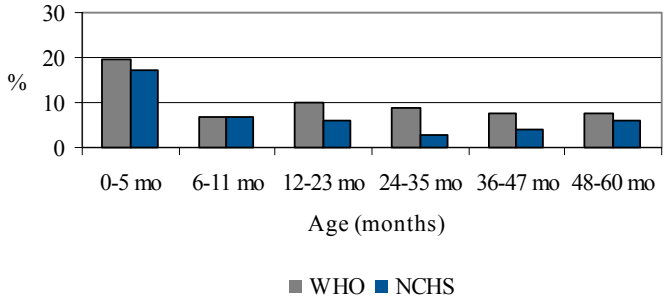
11.2 Peru, 2004-2008: Comparison of the prevalence of stunting using the WHO Standard vs. NCHS reference



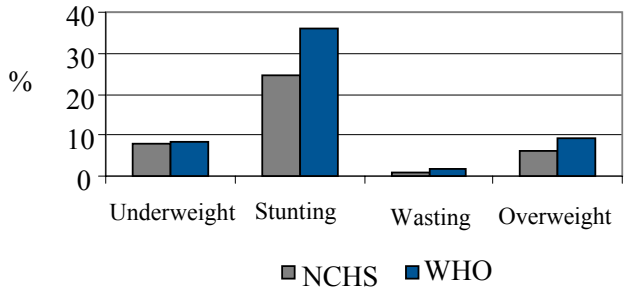
11.3 Peru, 2004-2008: Comparison of the prevalence of wasting using the WHO Standard vs. NCHS reference



11.4 Peru, 2004-2008: Comparison of the prevalence of overweight using the WHO Standard vs. NCHS reference

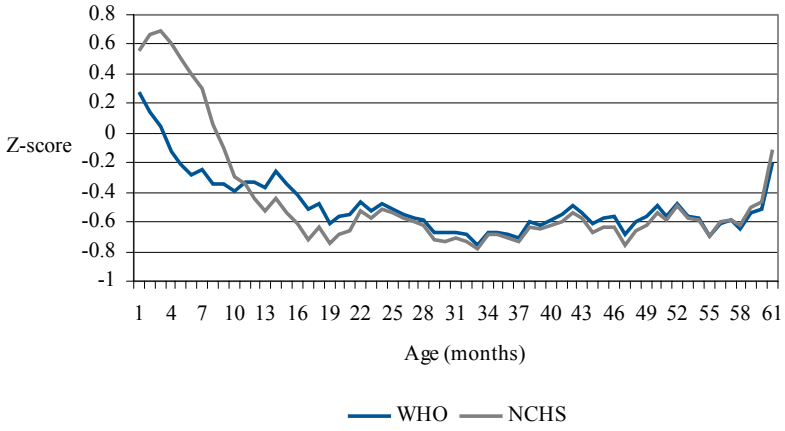


11.5 Peru, 2004-2008: Comparison of the prevalence of underweight, stunting, wasting and overweight using the WHO Standard vs. NCHS reference

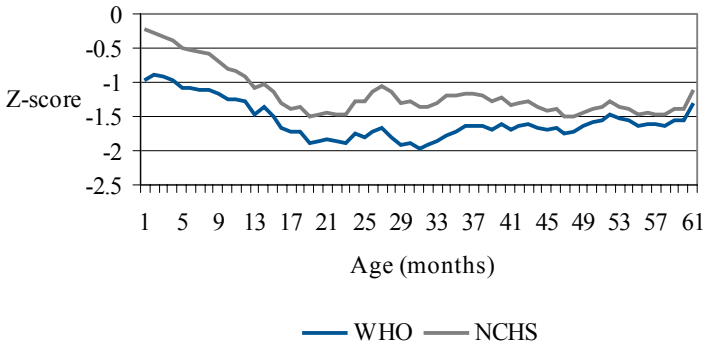


Figures 11.6-11.8: Comparison of five-month moving average Z-scores at each age using the WHO Standard vs. the NCHS reference

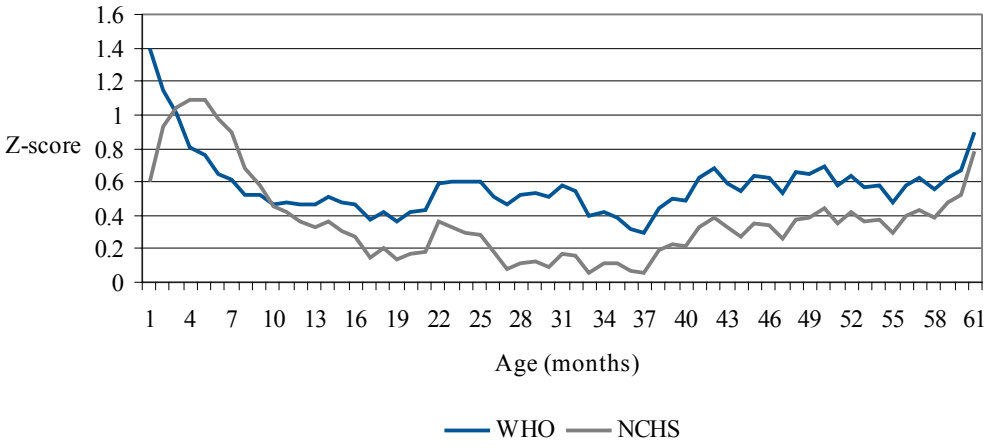
11.6 Peru, 2004-2008: Moving average weight-for-age Z-score using the WHO Standard vs. NCHS reference



11.7 Peru, 2004-2008: Moving average length/height-for-age Z-score using the WHO Standard vs. NCHS reference

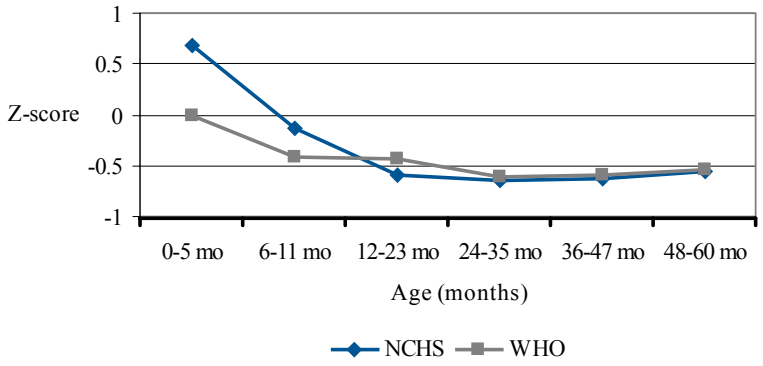


11.8 Peru, 2004-2008: Moving average weight-for-length/height Z-score using the WHO Standard vs. NCHS reference

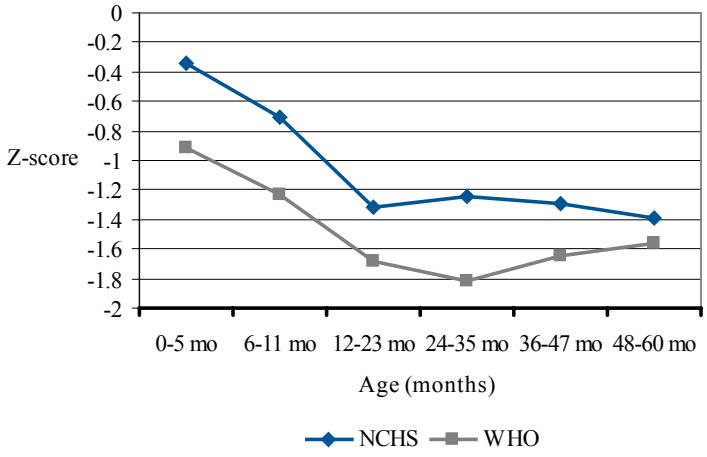


Figures 11.9-11.11: Comparison of mean Z-scores by age group using the WHO Standard vs. the NCHS reference

11.9 Peru, 2004-2008: Comparison of the mean weight-for-age Z-score by age group using the WHO Standard vs. NCHS reference



11.10 Peru, 2004-2008: Comparison of the mean length/height-for-age Z-score by age group using the WHO Standard vs. NCHS reference



11.11 Peru, 2004-2008: Comparison of the mean weight-for-length/height Z-score by age group using the WHO Standard vs. NCHS reference

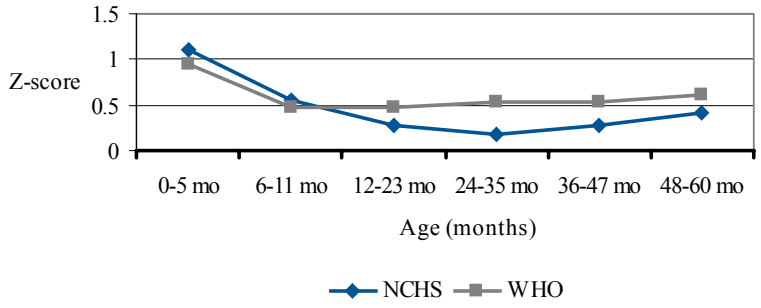


Figure 11.12: Five-month moving average for all anthropometric indicators using the WHO Standard

Peru, 2004-2008: Five-month moving average Z-scores for all anthropometric indicators using the WHO Standard

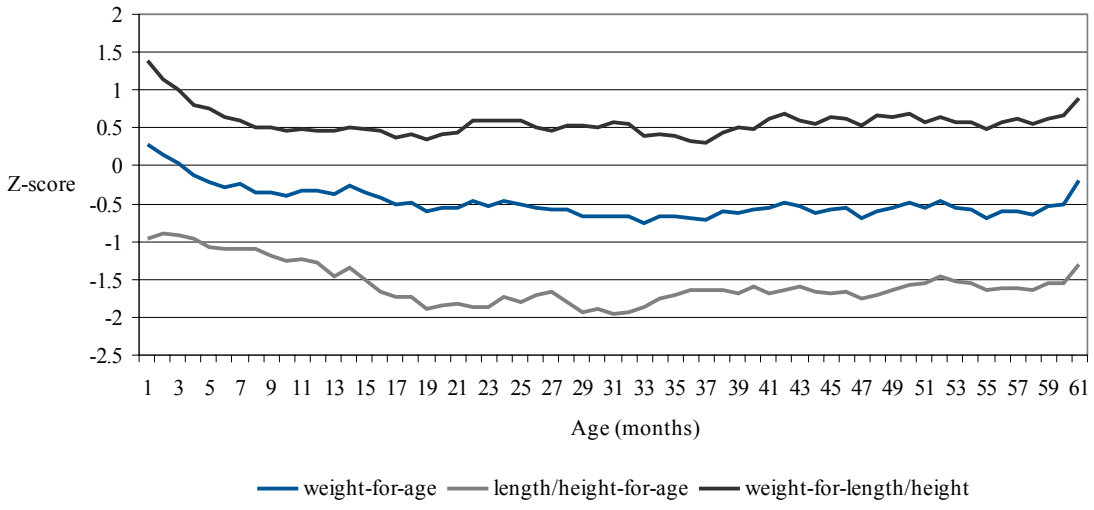
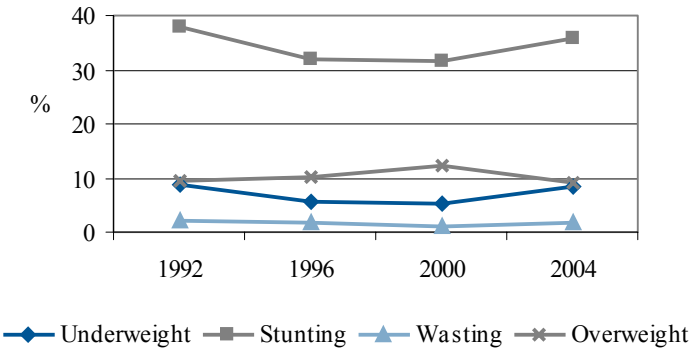
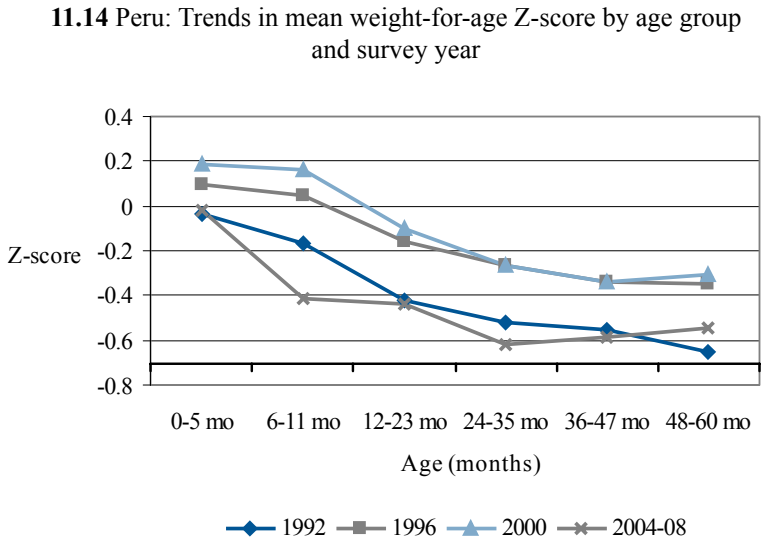


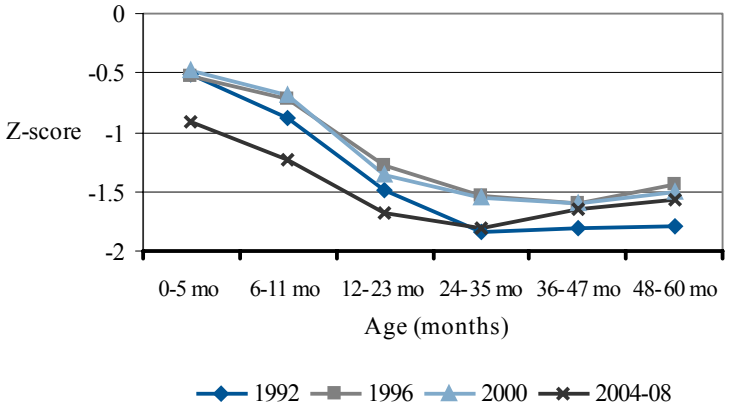
Figure 11.13: Trends in prevalence of all anthropometric indicators for children under five, Peru, 2004



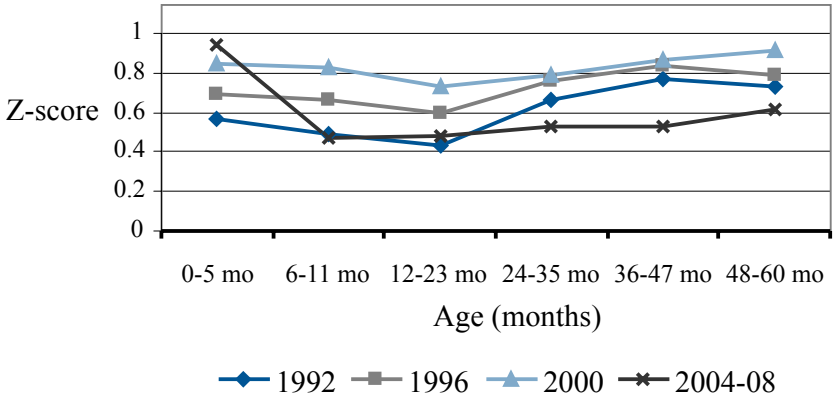
Figures 11.14-11.16: Trends in mean Z-scores by age groups, 2004



11.15 Peru: Trends in mean length/height-for-age Z-score by age group and survey year

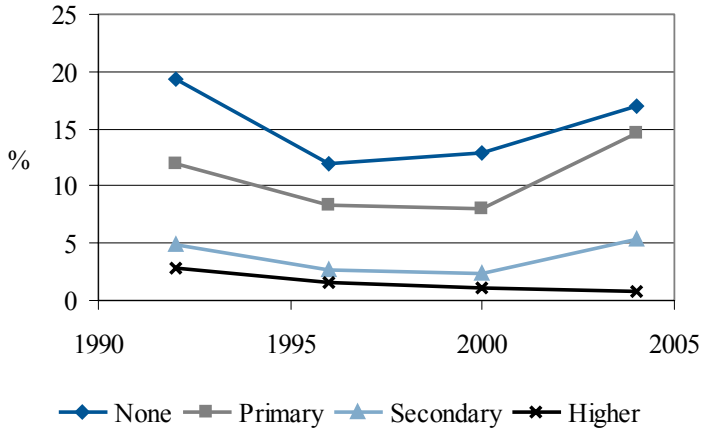


11.16 Peru: Trends in the mean weight-for-length/height Z-score by age group and survey year

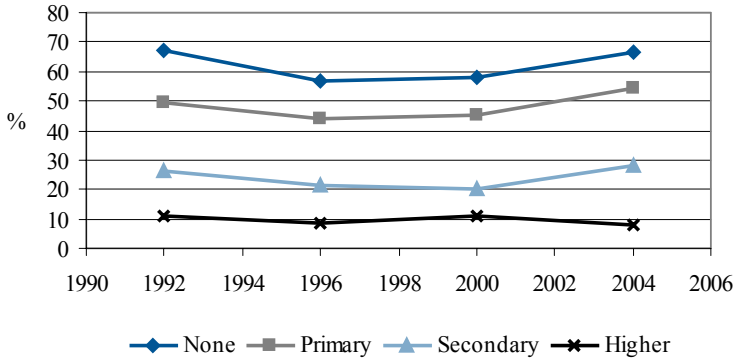


Figures 11.17-11.20: Trends in the prevalence of all anthropometric indicators by highest level of maternal education attained, 2004

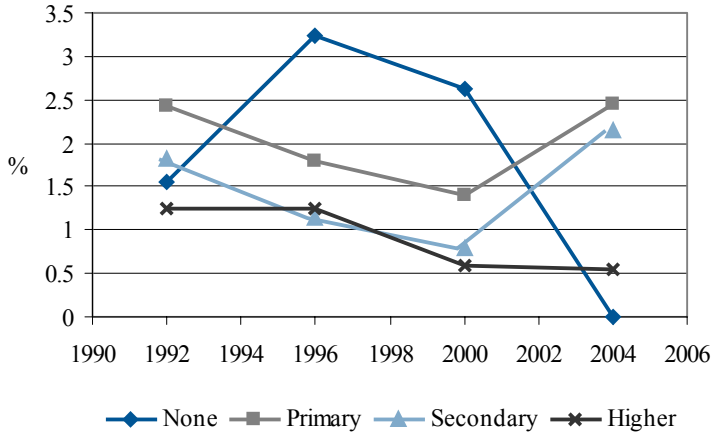
11.17 Peru: Prevalence of underweight by survey year and highest level of maternal education attained



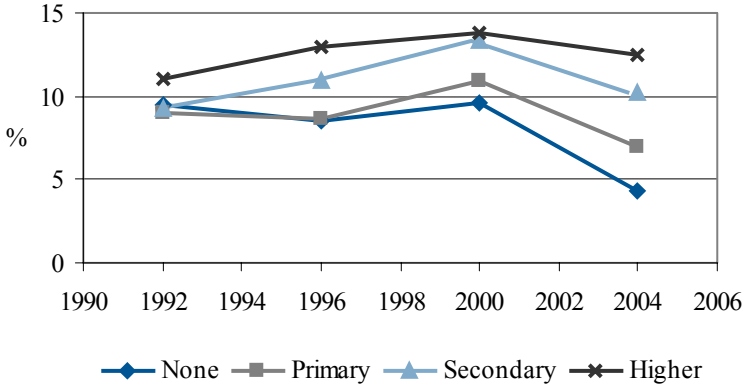
11.18 Peru: Prevalence of stunting by survey year and highest level of maternal education attained



11.19 Peru: Prevalence of wasting by survey year and highest level of maternal education attained



11.20 Peru: Prevalence of overweight by survey year and highest level of maternal education attained



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