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To develop the analytical model for this study, a technical team was formed at ECLAC to work with a technical team composed of representatives of governments of the Andean region (Bolivia, Ecuador, Paraguay and Venezuela) and staff members of WFP country offices. The country teams collected and processed national data and prepared the country reports, with input and training from ECLAC.
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Latin American leaders have underscored the urgent need to address the scourge of hunger and undernutrition as an ethical responsibility of the citizens and states of Latin America and the Caribbean. They cite the technical opinions of many researchers who emphasize the serious individual and collective consequences of having populations that lack sufficient food to meet their physical, intellectual and emotional development needs, which results in higher costs and losses in terms of health, education and productivity.

In response to the social and economic importance of the problem of hunger and child undernutrition in the region, the WFP and ECLAC agreed to carry out a joint project called “Analysis of the economic and social impact of hunger in Latin America” in 2005. This document presents the results of the study of the cost of undernutrition for Peru.

This document is a tool designed to promote the necessary alliances for each country to allocate the budgetary resources to carry out actions and initiatives aimed at combating this scourge.
Executive Summary

In Peru, 7.6% of children under five years of age had low weight-for-age (global undernutrition), slightly higher than the percentage for 2000 (7.1%). The group aged 12 to 23 months had the highest rates of global undernutrition at 10.7%.

After Bolivia and Ecuador, Peru has the highest prevalence of chronic undernutrition in South America, affecting nearly a quarter of children under five (24.2%). However, in absolute numbers of affected children under five, Peru is in first place.

According to estimates based on the 2005 National Demographic and Health Survey (known by its Spanish acronym: ENDES), 227,786 children under five years of age are affected by global undernutrition (moderate and acute) whereas 725,319 suffer from chronic undernutrition.

As highlighted by different studies conducted in the region, undernutrition in Peru peaks during the first 24 months of life. This and other factors suggest that young children living in rural areas are the most vulnerable. Indeed, the prevalence of global undernutrition in rural areas is 12.4%, compared with 3.1% in urban areas; in the case of chronic undernutrition, the prevalence is 39% and 10.1%, respectively.

Over the past 30 years, global undernutrition rates in Peru have decreased steadily – 8.3 percentage points – from 16.1% in 1975, 13.4% in 1984, 10.7% in 1991/1992 and 7.8% in 1996. Subsequently, this trend leveled off and then decreased by just 0.2 percentage points between 1996 and 2005, which resulted in a point of inflection on the curve in the latter period. This suggests that undernutrition could potentially increase in the future.

In part to address the undernutrition problem, according to official information, from 1990 to 2000, the country increased social spending by 3.7 percentage points of GDP (0.8 points for education and 0.7 for health). According to ECLAC, from 2000 to 2005, Peru earmarked approximately 9% of its GDP for public social spending, with an average of 3.1% for education and 1.5% for health, together accounting for 54% of social spending.²

As this report indicates, the effects and costs of undernutrition reflect the country’s nutritional history, which has caused health, education and productivity losses.

Considering 2005 as the base year, the global undernutrition affecting the different population cohorts is estimated to have cost approximately S/.7.882 billion, equivalent to US$2.391 billion. This figure represents 3% of GDP and a little more than one third of the country’s total social spending for that year.

The majority of these costs were the result of lost productivity of the working age population (15-64 years old) who were undernourished during their childhood. Moreover, US$910 million (38% of the total) are the result of the 2.2 years less schooling these individuals had while US$1.419 billion (59%) are due to the fact that 1,237 people did not reach their productive phase because the undernourished are more likely to die young.

The 286,000 additional events that the health system had to deal with in 2005, including those associated with global undernutrition, marasmus and kwashiorkor, as well as those resulting from greater risks for diarrhea, acute respiratory infections and anemia, are estimated to have cost US$53 million, which represents 2% of the total aforementioned cost and 5.6 times the cost assumed by the public health system in relation to these illnesses. Eighteen percent of these costs were assumed by the system whereas the remaining 82% were covered by families.

Additionally, the higher school failure rate associated with undernutrition resulted in an estimated 30,590 additional repeated school years in 2005 among those affected by preschool undernutrition, at a cost of US$10.2 million (0.43% of the total cost), equivalent to 0.42% of social spending on education.

These figures reflect the costs resulting from undernutrition among the entire population in 2005 (referred to as “incidental” because they occurred in a specific year). However, global undernutrition in the group of children ages 0-4 years will continue to negatively affect these individuals throughout their lives. Therefore, the costs associated with these future effects should also be analyzed; this is known as the prospective dimension. Studying this dimension enables us to estimate the savings attributable to interventions aimed at reducing or eradicating undernutrition.

The estimated cost for the 2005-2069 period, as a result of undernutrition affecting the 2005 cohort under five years of age, has a current value of US$346 million (S/.1.139 billion). Of this amount, US$264 million (76.4%) is the estimate for potential lost productivity over the children’s working lives (when these individuals are 15 to 64 years old).
In the case of health consequences, additional health care due to a higher level of morbidity (anemia, acute diarrhea and acute respiratory infections) and treatments for the undernourished (including marasmus and kwashiorkor) amount to US$78 million (22.6% of the total cost), including the US$53 million required for health care in 2005.

Lastly, the current value of the costs in the education sector amount to US$3.3 million (1.0% of the total cost), which represents the additional resources that the sector must provide to cover the higher rate of repeated school years for undernourished children in the cohort.

In order to reduce at least some of the aforementioned costs, long-term efforts are required; that is, sustained, effective and efficient policies and programs. In addition to the positive impacts that these would have on people’s quality of life, there would be considerable economic benefits. For example, if the interventions necessary for reaching the goal established in the Millennium Development Goals (to reduce the 1990 undernutrition level by half as of 2015) were to take place, the estimated savings for Peru would amount to US$245 million, a figure that would triple if the problem were eradicated. In this last scenario, 40% of the savings is the result of the impact produced by 2010.

In conclusion, the intergenerational consequences of undernutrition have a major impact on the Peruvian economy, not only in terms of health and education costs, but also because they seriously affect the productivity of its population and its capacity for socioeconomic development.
Child undernutrition is one of the scourges that affect developing countries such as Peru, whose consequences are evident throughout the life cycle. This situation increases the risk of morbi-mortality and inhibits the cognitive and physical development of girls and boys, chronically affecting their health and their future productive potential, with economic and social consequences for the individual and his or her family, community and country.

Recent World Health Organization (WHO) estimates indicate that 112 million boys and girls with low birth weight (LBW) are born annually. Of these cases, 13 million are due to intrauterine growth retardation (IUGR), while 178 million boys and girls under five have chronic child undernutrition (CCU). Of the total number of boys and girls with CCU, 160 million (90%) live in 36 countries, among which is Peru, where there are 938,000 cases (31.3%), and Guatemala, where the figure reaches 1,210,000 (59.9%). The highest figure corresponds to India, with 61,206,000 (51%), which is 50 times higher than the number in Guatemala and 65 times higher than that of Peru.

In the case of Latin America and the Caribbean, the food and nutrition situation is nothing more than a reflection of the inequality and social exclusion in which a large part of its population live. It is part of the vicious cycle of poverty, which is both a cause and a consequence of undernutrition.

To provide an idea of the magnitude of the inequality in access to food, according to estimates based on FAO food balance sheets, currently, food production for human consumption significantly exceeds the caloric requirements of the population. However, 52 million persons do not have adequate and/or sufficient access to food. In Latin America and the Caribbean, there are 8.7 million girls and boys suffering from CCU due to persistent inadequate food intake, and 4 million suffering from global undernutrition (GU).

This inequality in the region is also reflected in rural areas, where national averages frequently hide major gaps among the different regions of a country. For example, in the countries of the region, the probability that a child living in a rural area will suffer from global undernutrition is 1.5 to 3.7 times higher than for a child living in an urban area. The probability is at least four times higher among indigenous children. The Andean and Central American countries are clear examples of this situation. These differences are reflected in the intensity of the different food vulnerability factors, as well as in the different phases of demographic and epidemiological transitions they are undergoing.

A comparative study conducted by ECLAC in the Andean region in 2005 found significant differences in the incidence of child undernutrition among children under five who speak indigenous languages, compared to boys and girls whose first language is Spanish in Ecuador, Peru and Bolivia, according to national household surveys conducted from 1999 to 2000. Indigenous boys and girls were 1.6 to 2.4 times more likely to be the undernourished members of their control group.
1. Millennium Development Goals

Many of the Millennium Development Goals (MDG) are directly related to the efforts required to reduce hunger and undernutrition in the world population, among which reducing inequality is a fundamental factor. Thus, the first MDG: “Eradicate extreme poverty and hunger” has a target to halve, between 1990 and 2015, the proportion of people who suffer from hunger, which is directly related to this study.

In the case of Peru, in 1992 the national prevalence of global undernutrition recorded was 10.8%, with a goal of reducing it to 5.8% by 2015. This indicator shows favorable progress, as the value recorded in 2005 was 7.6%.

Regarding the number of households with insufficient caloric intake, as an approximate value, the National Survey of Households for 1998 reported a national average of 22.3% of households whose food intake was insufficient to meet their minimal nutritional needs. This indicator worsened in 2002, when it rose to 35.8%.

To analyze the nutritional situation of children in Latin America and the Caribbean, it is essential to consider chronic undernutrition (stunting) as an indicator in addition to global undernutrition (low weight-for-age) that is included in the MDG. In the region, chronic undernutrition affects 8.7 million children under five (15.4%) and reflects the accumulation of consequences of the lack of adequate food and nutrition during the most critical years of a child’s development (from the intrauterine stage to age three). The effects are largely irreversible and they are closely related to extreme poverty. The situation is particularly serious in Central American and Andean countries. Guatemala has the highest figure in the region, surpassing the averages for Asia and Africa. Peru is in fifth place and third among Andean countries; however, in absolute numbers, Peru is in first place.

2. The Country’s Economic and Social Situation

Currently, Peru is one of the countries with the best macroeconomic indicators in the region. From 2001 to 2006, it had average sustained growth of 4.8% of its GDP (the highest in the region) and an inflation rate of 1.96% (one of the region’s lowest), as shown in Table 1.

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2001</td>
</tr>
<tr>
<td>Real GDP (% var.)</td>
<td>0,21</td>
</tr>
<tr>
<td>Private Consumption (% var.)</td>
<td>1,50</td>
</tr>
<tr>
<td>Total Exports (% var.)</td>
<td>1,02</td>
</tr>
<tr>
<td>Consumer Price Index (Annual Avg. Var.)</td>
<td>2,00</td>
</tr>
<tr>
<td>Nominal Exchange Rate (% var.)</td>
<td>0,52</td>
</tr>
</tbody>
</table>

Source: Prepared in-house based on the Banco Central de Reserva del Peru (Central Reserve Bank) 2006 Annual Report
A large part of the economic growth is based on the sustained growth in the country's exports (traditional and non-traditional),\textsuperscript{18} private investment (with the real estate sector as a strong component) and a higher private consumption, reversing the negative private investment rates recorded in the 1990s. Trade opening and legal stability, together with the near elimination of political violence in the country, have been the general framework for this economic improvement process.

However, these positive national indicators have not necessarily been reflected in the country's social welfare. With nearly half of the population living in poverty, education indicators that place the country among those lagging behind in the region and high undernutrition levels, economic growth is still contradictory, since it is not reflected in improved macroeconomic levels. For example, the Gini coefficient\textsuperscript{19} decreased from 0.525\textsuperscript{20} to 0.505 during the 2000-2005 period.

### 3. Nutritional Situation

In 2005, 7.6\% of the boys and girls under five suffered from global undernutrition\textsuperscript{21}, which was a slight increase compared with the figure for 2000 (7.1\%). If this figure continues to increase or remains stable, it is quite possible that the country will not achieve its MDG commitment.
Looking at the long-term trend, the prevalence of global undernutrition in Peru has decreased steadily over the past 30 years, especially during the 1975-1996 period (8.3 percentage points lower), remaining relatively stable since 1996 (approximately 8%).

Regarding chronic undernutrition, despite the 10.7 percentage point reduction at the national level, from 36.5% (1990) to 25.8% (1996), the level of prevalence has remained almost the same in recent years, decreasing slightly from 25.4% (2000) to 24.2% (2005).

An analysis of the characteristics of the population affected reveals greater prevalence of global undernutrition in children from 24 to 47 months of age (13.2%); additionally, global undernutrition is greater in boys and girls who have suffered from severely restricted intrauterine growth (nearly 17 out of 100 children with low birth weight suffer from undernutrition).

With regard to geographic distribution, global undernutrition is greater among boys and girls living in rural areas (12%) and in the highlands and jungle (10%). Children whose mothers have lower levels of education also show higher rates (18.2% for children of illiterate women and 12.5% for children of mothers who have only completed primary school). By the same token, in relation to economic level, children from the bottom quintile of income are more affected, where the undernutrition level is 15.8%.

It should also be noted that, as in other Andean countries, “boys and girls from indigenous language-speaking families have a significantly higher probability of suffering from undernutrition than those from non-indigenous language-speaking families” (ECLAC, 2005). In the case of Peru, in 2000, the Endes survey found a prevalence of 48.1% among children of indigenous families, as compared with 21.4% for non-indigenous children. It is also noteworthy that among those who speak Quechua, the rate rises to 49.2%, while for those who speak Aymara, it is 34.5%.

**Table 2**

Peru: Children and global undernutrition, by age group

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Newborn (IUGR)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 to 11 months</td>
<td>605,453</td>
<td>10,898</td>
<td>5.1%</td>
</tr>
<tr>
<td>12 to 23 months</td>
<td>597,358</td>
<td>63,917</td>
<td>15.9%</td>
</tr>
<tr>
<td>24 to 59 months</td>
<td>1,794,377</td>
<td>156,11</td>
<td>10.9%</td>
</tr>
<tr>
<td>Total</td>
<td>2,997,188</td>
<td>230,926</td>
<td>10.7%</td>
</tr>
</tbody>
</table>


Note 1: In a given year, the population of newborns is the same as the population aged 0 to 11 months.
Note 2: Estimate based on the latest prevalence figure available.
Regarding the evolution of the risk of undernutrition during the first years of life, as highlighted by different studies conducted in the region, in Peru, undernutrition problems peak in the first 24 months of life (reaching nearly 10.7% in 2005), with a subsequent decrease and stabilization in the remaining preschool phase.

Low birth weight (LBW)\textsuperscript{23} is a risk factor for the health and survival of newborns, as well as for their future nutritional status. In 2005, among boys and girls who were weighed at birth, 8% weighed less than 2.5 kilograms, which was higher than the 6% found in the Endes surveys of 1996 and 2000.

![Figure 4](Peru: Undernutrition prevalence by age group, 2005)

![Figure 5](Social spending as a percentage of GDP, by sector, Peru, 2000-2005)

Among South American countries, Peru has the second highest prevalence of global undernutrition\textsuperscript{24} after Ecuador, with rates similar to those of Bolivia and Colombia.

The country’s socioeconomic inequality is reflected in the differences in prevalence of child undernutrition: low weight-for-age in the bottom quintile is 15.8% compared with 1.9% in the top quintile. Similarly, chronic undernutrition in the bottom quintile is 45.8% compared with 4.4% in the top quintile.

In part to address the undernutrition problem, in 2005, Peru earmarked 9% of its GDP for social spending (including pension benefits), with an average of 3.1% for education and 1.5% for health care, which together accounted for 54% of total social spending. In terms of social spending as a percentage of GDP, from 1990 to 2000, total social spending increased 3.7% (0.8% for education and 0.7% for health care).\textsuperscript{25} From 2000 to 2005, total social spending rose from 8% to 9% (mostly for health care), peaking at 10% in 2003.

Although there are still considerable levels of under-reporting of information (under-reporting decreased from 28% in 2000 to 18% in 2005), it is important to note that this LBW indicator is 46% among the poorest mothers and 39% to 45% among mothers who give birth to a sixth or subsequent child and non-educated mothers, respectively. Additionally, this indicator is 33% among mothers living in rural areas, which is a cause for concern because it reflects an under-reporting of information that could distort the real magnitude of LBW.
It should be noted that the increase observed in the 1990s was mainly in operational costs (salaries and social benefits), a component that increased from 11.5% in 2000 to 21.9% in 2005.

![Figure 6: Composition of social spending. Peru, 2000-2005.]

Source: ECLAC, Social Development Division, Social Expenditure Database

4. Institutional situation regarding food and nutrition security

The food/nutrition issue is currently an important one in Peru, as one of the priorities on the current administration’s political agenda is achieving a 10 percentage-point reduction in chronic child undernutrition during its term.28

In this regard, a series of actions has been coordinated among the different sectors of the government in order to reach the established goal. The protection of human capital is one of the highest-priority commitments of the current administration, which reflects the firm political decision to attain it. The administration has established concrete goals and called for technical support from cooperating agencies, institutions and people committed to the fight against poverty and chronic undernutrition through coordinated efforts.

On August 24, 2006, the president of the Council of Ministers presented the administration’s highest political priorities to Congress, sustaining that the priority is “to overcome poverty and reduce the inequality and exclusion that affect over 13.5 million Peruvians. The strategy is aimed at capacity building and the state must ensure that the conditions exist for this to occur.” Within this framework, the President of Peru set a goal of reducing chronic child undernutrition by 10 percentage points by 2011, for which reason efforts must be directed toward combining public and private resources to address the causes in a comprehensive – rather than sectorial – manner. In this way, the commitment has become an operational tool for achieving the objectives established in the National Strategy for Fighting Undernutrition, approved through Executive Decree No. 055-2007-PCM on July 2, 2007, which establishes joint intervention by the national, regional and local governments in the fight against child undernutrition. The Interministerial Commission on Social Issues (Spanish acronym: CIAS) is in charge of coordinating and following up the Crecer (Grow) Program, the purpose of which is to join efforts to guarantee that all boys and girls under five in Peru are well nourished.

Another important action was reforming the Ministry of Women and Social Development’s (Mimdes) nutritional programs under the management of the National Food Assistance Program (known by its Spanish acronym, Pronaa), merging the six original programs into one called the Comprehensive Nutrition Program (Spanish acronym: PIN), whose purpose is to protect and develop human capital within the framework of fundamental human rights. Additionally, this reform provides for a change from an assistance approach to a preventive/promotional approach, with the educational component as a fundamental pillar.27
Peru has important legal instruments that provide the necessary framework to combat hunger and undernutrition at all levels. These include:

1. **The government's Fifteenth Policy**, which explicitly calls for the promotion of food and nutrition security in the following terms:

   “...To establish a food security policy that makes sufficient food of adequate quality available and accessible to the population in order to guarantee an active, healthy life within the concept of integral human development...

   “…Shall develop an intersectorial, participatory food security policy with decentralized programs that deal with the problem of undernutrition in a comprehensive manner...”

2. **Executive Decree No. 118-2002-PCM: National Food Security Strategy (ENSA).**

   This document makes the goals of the country’s food policy explicit, with a comprehensive approach to access, availability and use of food, as well as the sustainability of its production. It also incorporates a territorial development approach, since it makes it clear that the food policy itself must be defined within the most pertinent territorial spaces; that is, policy actions should not necessarily be limited to political-administrative borders, but rather to geopolitical spaces, such as economic corridors.

   The goals related to food security to be attained by 2015 are also specified. The main goals indicated are a reduction in the percentage of children under three and pregnant women with inadequate food and nutrition practices, from 60% to 40%; a reduction in chronic undernutrition in children under five, from 25% to 15%; a reduction in households with a caloric deficit, from 35.8% to 25%; an increase in the food trade surplus (due to increased productivity); and, lastly, a 10% increase in the per capita daily availability of calories from foods of domestic origin.

3. **National Plan of Action for Children and Adolescents.**

   The National Plan of Action for Children and Adolescents 2002-2010, approved by Executive Decree No. 003-2002-Promudeh, which has the force of law according to Law No. 28487, also establishes objectives aimed at fostering healthy living for boys and girls. Its Strategic Objective No. 1, “To ensure healthy living for boys and girls aged 0 to 5 years,” considers the rights established by the Convention on the Rights of the Child: right to life, right to health and nutrition, right to development and social protection. Within this framework, expected outcomes by 2010 include the following:

   - **Conditions created for healthy, safe pregnancy and childbirth:**
     - Goal: To incorporate 85% of the expectant mothers living in areas of extreme poverty as users of the nutritional supplementation program.

   - **All boys and girls under two have access to breastfeeding and optimal complementary nourishment:**
     - Goal: To reduce the percentage of newborns with low birth weight by 20%.
     - Goal: To reduce chronic undernutrition among children under three by 20%, nationwide.
     - Goal: To improve the nutritional status of 80% of the boys and girls under two.

   - **Boys and girls have improved nutritional status in terms of micronutrients:**
     - Goal: To reduce chronic undernutrition by 20%.
     - Goal: To reduce acute undernutrition in areas of extreme poverty by 30%.
     - Goal: To eliminate diseases caused by vitamin A deficiency in a sustainable manner.
     - Goal: To reduce the prevalence of anemia among boys and girls under three by 40%.
The main purpose of this study is to measure the economic impact of global child undernutrition in Peru in 2005, using an econometric model to estimate the effects and costs associated with child undernutrition in relation to health, education and productivity. The study is also intended to estimate the potential economic savings that would result from the eradication of child undernutrition in the country.

The model is based on the hypothesis that undernutrition in children under five is associated with a greater probability of disease and death in early childhood (0-4 years old), which in turn results in a greater probability that these individuals will have to repeat years of school when they are school-age (6-18 years old), which affects their productivity as adults (15-64 years old), due to fewer years of education completed and an increased risk of premature death among those who were undernourished as children.

This study used two analytical dimensions to determine effects and costs:

1. **Retrospective incidental:**

   This considers the effects from “yesterday until today” that have an impact on costs “today”. This makes it possible to estimate the cost generated by global child undernutrition for a given year under analysis (2005). The total cost includes health-related costs for preschool boys and girls (0-4 years) who were undernourished in 2005; the educational costs derived from the undernutrition suffered during the first five years of life among school-age individuals (6-18 years) in 2005; and the economic costs due to loss of productivity among working-age
individuals (15-64 years) in 2005, who were undernourished during their first five years of life.

2. Prospective or potential savings:

This estimates the effects “today” that have an impact on costs “today and tomorrow”. This dimension makes it possible to project present and future economic losses due to medical attention, repeated school years and reduced productivity as a result of undernutrition affecting children under five in Peru in a specific year (2005). Based on these projections, it is possible to estimate potential savings if the necessary actions are taken to achieve nutritional objectives (for example, Target 3 of the first Millennium Development Goal: “Halve, between 1990 and 2015, the proportion of people who suffer from hunger”).
This section of the report presents the results of the estimates of the consequences of global undernutrition in Peru as of 2005 in relation to health, education and productivity.

In Chapter I, estimates from a retrospective incidental dimension are presented. These are the health-related effects and costs for preschool boys and girls (0 to 59 months) who were undernourished in that year; the education-related effects and costs as a result of undernutrition during the first five years of life of those who were school-age (7 to 18 years) in the year under analysis; and the economic costs resulting from a loss of productivity among working-age individuals (15 to 64 years) who experienced undernutrition before reaching the age of five.

Chapter II presents estimates made for the prospective or potential savings dimension, that is, present and future losses associated with health, repeated school years and reduced productivity, as a result of the prevalence of global undernutrition in the country among children under five in 2005.

Lastly, Chapter III estimates the savings that could be obtained if the necessary actions are taken to achieve the country’s nutritional goals in three possible scenarios: a continuation of the current prevalence of undernutrition (7.6%), reducing it to 5.8% (putting it on a millennium-goal level) or eradicating it (2.5%).

1. Health

1.1 Health-related effects

Undernutrition at an early age predisposes a person to a greater risk of morbidity, as well as mortality, which can by analyzed through probability differentials.

In order to estimate these effects, data were taken from the National Demographic and Health Survey (Endes), which is representative of the universe of households nationwide. Interviews with specialists from the Ministry of Health complemented this information.
1.1.1 Morbidity

In Peru, the effects of undernutrition on the morbidity rates of the different associated diseases would have resulted in 44,306 additional cases in 2005. Among these, acute diarrheal disease (ADD), with 9,847 cases, acute respiratory infections (ARI), with 15,582 cases and iron deficiency anemia, with 18,877, stand out. This situation is a result of the differences in prevalence (DP) shown in Table 3.

The greater differences in prevalence among undernourished children and those who were not undernourished occur in the first year of life for the three illnesses. The difference in the prevalence of anemia in undernourished children compared with children who were not undernourished in the group aged 0 to 11 months is approximately 18%, and 11% in children aged 24-59 months. However, there are no significant differences for the group aged 12-23 months.

The difference in the prevalence of ADD in the group aged 0-11 months is approximately 10% (OR=1.7); in the group aged 12-23 months, it decreases to 8% (OR=1.5), and further decreases to 2.3% in children aged 24-59 months (OR=1.4).

In the case of ARI, the difference in the prevalence is greater in the group aged 1-11 months (21%), and decreases progressively among children aged 12-23 months (9%) and those aged 24-59 months (5%).

In addition to the aforementioned illnesses, there are disorders related to critical nutritional deficiency in calories and protein, such as marasmus and kwashiorkor. In 2005, there were 744 cases reported, accounting for less than 1% of the population of children under age five in Peru.

1.1.2 Mortality

There are several illnesses through which undernutrition affects mortality, including: diarrhea, pneumonia, malaria and measles. To limit the errors derived from the quality of official records on causes of death, in order to assess the situation in each country, the estimates made by Fishman et al. (WHO 2004), which defined relative risk differentials for all causes of death among children under five, were considered together with the mortality rates estimated by the Centro Latinoamericano de Demografía / Latin American Demographic Center (Celade).

Based on the above, it is estimated that from 1941 to 2005, slightly more than 1.7 million children under five would have died from causes associated with undernutrition. Considering survival rates for the different cohorts throughout the period, 81% (1.38 million) would still have been alive in 2005 if they had not suffered from global undernutrition. Additionally, it is estimated that of the total number of deaths among the population under five in 2005, nearly 39,000 (18%), would have been associated with global undernutrition.

As shown in Table 4, from 1941 to 1990, undernutrition was the apparent cause of death of 1,237,626 children under five who would have been between 15 and 64 years old in 2005 and, therefore, would belong to the working-age population (WAP). As indicated in section 3 of this chapter, this has a significant impact on the country’s productivity.
1.2 Health-related costs

Institutional (public system) and private health-related costs resulting from increased health care related to pathologies associated with undernutrition, which afflict children under five, are concentrated in the group aged 12 to 59 months: 91% of the population affected and 89.3% of the total health-related costs for the cohort during the year. However, the highest unit costs are those for newborns with intrauterine growth retardation (LBW-IUGR) due to the fact that the costliest health care protocols are the ones for this group.

Estimated public and private health costs for Peru in 2005 totaled S/.174 million, equivalent to US$52.7 million, which represents 4.3% of health-related social spending for the year and approximately 5.6 times the cost assumed by the public system in relation to these pathologies.

An analysis of these costs shows that 18% correspond to the public sector and 82% to families. The greatest cost to families corresponds to the time and transportation required for medical attention, as well as medical supplies not covered by the public health system.

### Table 5
Cost of global undernutrition in relation to health
Peru, 2005

<table>
<thead>
<tr>
<th>Age</th>
<th>Number of Cases</th>
<th>Millions of nuevos soles</th>
<th>Million of 2005 dollars</th>
</tr>
</thead>
<tbody>
<tr>
<td>Newborn (IUGR)</td>
<td>10.815</td>
<td>3.4</td>
<td>1.0</td>
</tr>
<tr>
<td>28 days to 11 months</td>
<td>16.423</td>
<td>15.2</td>
<td>4.6</td>
</tr>
<tr>
<td>12 to 23 months</td>
<td>75.013</td>
<td>55.6</td>
<td>16.9</td>
</tr>
<tr>
<td>24 to 59 months</td>
<td>184.540</td>
<td>99.7</td>
<td>30.3</td>
</tr>
<tr>
<td>Total</td>
<td>286.791</td>
<td>173.9</td>
<td>52.8</td>
</tr>
</tbody>
</table>

Source: prepared in-house based on Celade-ECLAC population and mortality statistics, National Demographic and Health Survey 2005 and administrative records of the Ministry of Health –Peru.

The 287,000 cases requiring medical attention due to diseases associated with undernutrition shown in Table 5 include 241,000 direct treatments required by boys and girls solely because they were undernourished.

2. Education

2.1 Effects on education

In the regional context, educational coverage reported in the official Peruvian statistics is high for primary education (97.1%) and relatively low for secondary education (68.8%).

According to the Endes survey for 2005, average schooling among the adult population (20 to 64 years) is nine years, reflecting a progressive increase in schooling. Among those who are 55 to 64 years old, average schooling is almost five years less than for those from 20 to 24 years old. Nevertheless, academic success remains low, especially in terms of the average number of adults who finished high school, which is less than 20% of the national population.

The undernourished population has a lower proportion of students who finished high school (27%) compared with students who were not undernourished (76%). These differences are very important indicators in terms of job opportunity and income gaps between the two groups throughout their working lives.
Between the primary and secondary levels, students with undernutrition had an average of 2.2 fewer years of schooling than students who were not undernourished. This is partially due to the fact that among those who suffered from undernutrition in their preschool phase, there is a larger proportion that never attended primary school.

Global undernutrition in Peru is estimated to have caused 30,590 additional students to repeat school years in 2005, which implies increased costs. Of these, 65% were in primary school. It should be noted that children who have suffered from undernutrition show a greater concentration of cases of repeating the first years of primary school than “normal” children. However, as shown in Figure 7, in both groups, the rates are higher at the secondary-school level, but there is always a gap between those who have suffered from undernutrition and those who have not.

2.2 Education-related costs

The additional operating costs due to a greater rate of school years repeated by those who have suffered from undernutrition is one of the major costs of education. The nearly 31,000 additional students estimated for 2005 due to the probability of repeating school years imply a cost differential of S/.33.4 million, equivalent to US$10.2 million, which accounts for 0.4% of social spending on education and 0.013% of GDP for that year.

<table>
<thead>
<tr>
<th></th>
<th>Primary</th>
<th>Secondary</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Annual cost per student (2005 nuevos soles)</strong></td>
<td>1.019</td>
<td>1.247</td>
</tr>
<tr>
<td><strong>Annual additional cost (thousands of 2005 nuevos soles)</strong></td>
<td>20.221.542</td>
<td>13.205.737</td>
</tr>
<tr>
<td><strong>Annual additional cost (thousands of 2005 dollars)</strong></td>
<td>6.135.471</td>
<td>4.006.787</td>
</tr>
<tr>
<td><strong>Social spending on education</strong></td>
<td>0.42%</td>
<td></td>
</tr>
<tr>
<td><strong>% GDP</strong></td>
<td>0.013%</td>
<td></td>
</tr>
</tbody>
</table>

Source: ECLAC, based on official data from the Ministry of Education (2005)
Productivity

3.1 Effects on productivity

As previously indicated, undernutrition has a negative impact on the productive capacity of a country, which is a result of the greater prevalence of mortality among children under five due to pathologies associated with undernutrition, as well as the lower educational level attained by the undernourished population.

Table 7 shows the magnitude of the loss of productivity as a consequence of the 1.24 million deaths of children under five who, if they had not died of undernutrition, would form part of the working-age population (WAP). Considering the country’s employment rates per cohort, the resulting cost is equivalent to 1.916 billion man hours, which is equivalent to nearly 11% of the hours worked by the economically active population (EAP).

Table 7
Effects of global undernutrition on productivity due to mortality in Peru, 2005

<table>
<thead>
<tr>
<th>Age group</th>
<th>Mortality due to undernutrition (No., 1941 – 1990)</th>
<th>Lost hours of work (2005)</th>
</tr>
</thead>
<tbody>
<tr>
<td>15-24 years old</td>
<td>198,493</td>
<td>147,571,429</td>
</tr>
<tr>
<td>25-34 years old</td>
<td>297,605</td>
<td>500,619,219</td>
</tr>
<tr>
<td>35-44 years old</td>
<td>299,455</td>
<td>566,356,415</td>
</tr>
<tr>
<td>45-54 years old</td>
<td>248,677</td>
<td>436,298,136</td>
</tr>
<tr>
<td>55-64 years old</td>
<td>193,396</td>
<td>265,894,289</td>
</tr>
<tr>
<td>Total</td>
<td>1,237,626</td>
<td>1,916,739,488</td>
</tr>
<tr>
<td>Hours lost in relation with to the EAP</td>
<td>10.9%</td>
<td></td>
</tr>
</tbody>
</table>

Source: prepared in-house based on Celade-ECLAC population and mortality statistics, relative risks estimated by Fishman et al., and the National Demographic and Health Survey 2000.

The negative effect on productivity due to the schooling gap corresponds to the differences in the distribution of the population by years of primary and secondary education among those who have suffered from global undernutrition and those who have not. The figure below shows the educational level attained among those who attended school.

Figure 8 shows that, on average, the globally undernourished achieved a lower level of education: completed primary school is the highest level reached by 70% of the undernourished, compared with those who were not undernourished, the majority of whom attended secondary school, regardless of whether they graduated (63%).
3.2 Productivity costs

The higher productivity costs correspond to the economic value of the previously mentioned effects. For 2005, it is estimated that the lower level of schooling generated losses amounting to S/.3 billion, equivalent to US$911 million, which represents approximately 13% of social spending for the year, 37% of public spending on education and approximately 1.15% of GDP.

In addition, the loss of productivity due to the deaths that it is estimated were caused by undernutrition among the population that would have been members of the working-age population in 2005 has been calculated at nearly S/.4.7 billion, equivalent to US$1.419 billion, which accounts for 1.8% of GDP.

4. Cost summary

In summary, for 2005, the global undernutrition experienced by the population of the different cohorts generated an approximate cost of S/.7.882 billion, equivalent to US$2.391 billion. These values represent 3% of GDP and a little over a third of the country’s total social spending for that year.

As shown in Figure 9, the costs related to loss of productivity due to mortality and years of schooling account for 97% of the total cost, while the costs associated with morbidity and repeated school years due to undernutrition represent 2% and 1%, respectively.

In conclusion, the intergenerational consequences of undernutrition have a major impact on the Peruvian economy, not only in terms of health care and education costs; but also because they seriously affect the productivity of the population and its capacity for socioeconomic development.

![Figure 9: Distribution of the cost of global undernutrition by factors. Peru, 2005 (retrospective incidental dimension).](source: prepared in-house)

<table>
<thead>
<tr>
<th>Table 8</th>
<th>Summary of results: effects and costs of undernutrition. Peru, 2005 (retrospective incidental dimension)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Units</td>
</tr>
<tr>
<td>HEALTH</td>
<td></td>
</tr>
<tr>
<td>Increased cases of morbidity</td>
<td>286.791</td>
</tr>
<tr>
<td>Number of additional deaths</td>
<td>1,237.626</td>
</tr>
<tr>
<td>EDUCATION</td>
<td></td>
</tr>
<tr>
<td>Additional school years repeated</td>
<td>30.590</td>
</tr>
<tr>
<td>Desertion differential</td>
<td>305.866</td>
</tr>
<tr>
<td>PRODUCTIVITY</td>
<td></td>
</tr>
<tr>
<td>Loss of MH due to mortality</td>
<td>1.916.739.488</td>
</tr>
<tr>
<td>Fewer years of schooling</td>
<td>2.2</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
</tr>
<tr>
<td>Social spending</td>
<td></td>
</tr>
<tr>
<td>GDP %</td>
<td></td>
</tr>
</tbody>
</table>

Source: prepared in-house
II. Effects and costs in relation to the 0-59 month-old cohort of 2005 (analysis of the prospective dimension)

Through this dimension, an estimate can be made of present and future losses (and potential savings) related to health care, repeated school years and lower productivity as a consequence of the prevalence of global undernutrition in Peru in 2005 among children under five years of age.

1. Health-related effects and costs

As indicated in the preceding chapter, undernutrition at an early age increases a person’s risk of dying young and suffering from certain diseases.

Based on census data projections, it is estimated that among members of the cohort of 2005 between the ages of 0 and 59 months, 64,497 will die before they turn five. Of these, nearly 31,000 (47.3%) deaths will be associated with undernutrition, of which 11,666 cases correspond to 2005.

Table 9
Mortality associated with global undernutrition in children under age five
Peru, 2005-2009

<table>
<thead>
<tr>
<th>Age</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>TOTAL</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 a 11 months</td>
<td>4.004</td>
<td>4.004</td>
<td></td>
<td></td>
<td>1.886</td>
<td>4.004</td>
<td>13%</td>
</tr>
<tr>
<td>12 a 59 months</td>
<td>7.663</td>
<td>7.683</td>
<td>5.723</td>
<td>3.791</td>
<td></td>
<td>26.745</td>
<td>87%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>11.666</td>
<td>7.683</td>
<td>5.723</td>
<td>3.791</td>
<td>1.886</td>
<td>30.749</td>
<td>100%</td>
</tr>
</tbody>
</table>

As shown in Table 9, the highest incidence of death occurs in the first year of life, during which the probability of death is twice that of the rest of the cohort. However, over 26,000 children may die from causes linked to global undernutrition between the ages of 1 and 4 years.

Regarding morbidity, for Peru it is estimated that in the first five years of life, in the cohort from 0 to 59 months in 2005, there will be nearly 67,000 additional cases of diseases associated with global undernutrition, mainly anemia, acute diarrhea and acute respiratory infection. Of these, 61% are likely to occur in the group from 24 to 59 months old.

Table 10
Morbidity associated with global undernutrition in children under age five
Peru, 2005-2009

<table>
<thead>
<tr>
<th>Age</th>
<th>Total estimated cases of disease</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2005</td>
</tr>
<tr>
<td>0 a 11 months</td>
<td>5.525</td>
</tr>
<tr>
<td>12 a 23 months</td>
<td>11.096</td>
</tr>
<tr>
<td>24 a 59 months</td>
<td>28.429</td>
</tr>
<tr>
<td>TOTAL</td>
<td>45.050</td>
</tr>
</tbody>
</table>

Source: prepared in-house based on Celade-ECLAC population and mortality statistics, relative risks reported by Fishman et al., and the National Demographic and Health Survey 2005

In addition to the cases of morbidity indicated in Table 10, there is the direct medical attention required by underweight boys and girls, which total 241,742 appointments in 2005 and another 124,278 million from 2006 to 2009. Of these, 10.815 million correspond to children with low birth weight due to intrauterine growth retardation (LBW-IUGR).
The additional health-related costs as a result of additional cases of diseases caused by undernutrition amount to US$51.7 million only for 2005, with a net present value (NPV)\(^{18}\) of US$78.25 million during the 2005-2009 period (S/.258 million).

### Table 11
Costs of morbidity associated with global undernutrition
Peru, 2005–2009 (millions of 2005 dollars)

<table>
<thead>
<tr>
<th>Age</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>Newborn</td>
<td>1.02</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 a 11 months</td>
<td>4.63</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 a 23 months</td>
<td>16.87</td>
<td>14.71</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24 a 59 months</td>
<td>30.25</td>
<td>8.14</td>
<td>4.10</td>
<td>0.87</td>
<td>0.17</td>
</tr>
<tr>
<td>TOTAL</td>
<td>52.76</td>
<td>22.85</td>
<td>4.10</td>
<td>0.87</td>
<td>0.17</td>
</tr>
<tr>
<td>NPV</td>
<td>78.25</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: prepared in-house based on Celade-ECLAC population and mortality statistics, relative risks reported by Fishman et al., and the National Demographic and Health Survey 2005

The values indicated in Table 11 imply an annual equivalent cost (AEC)\(^{19}\) of S/.78 million; that is, US$23.6 million in that period, which represents approximately 1.11% of social spending on health care and 0.03% of GDP.

#### 2. Education-related effects and costs

When projecting the education process for children under age five in 2005,\(^{40}\) an estimate is made for the differential probability of academic achievement, as well as the corresponding cost of educating 366,000 additional Peruvian students who are expected to be undernourished in their first five years of life.

According to official information, it is possible to estimate that from 2007 to 2022, there will be 20,371 additional cases of repeated school years. Of these, 85.6% will occur in primary education and 14.4% in secondary, as there is greater coverage at the primary school level.

As a result of the additional repeated school years, education costs, stated at present value (at a discount rate of 8%), will amount to S/.21.4 million, equivalent to US$6.5 million.

The estimate of these values as an equivalent annual cost over the 16-year period during which the cohort analyzed will be school-age (2007-2022) amounts...
to S/.10.9 million; that is, US$3.3 million in 2005 dollars, which represents 0.01% of social spending on education and 0.0005% of GDP for that year. Of these costs, 28% will be assumed by the children’s families and 72% will be covered by the educational system. In addition, the greater risk of quitting school among undernourished children indicates that 32,771 students will drop out of school due to undernutrition.

As a result of the above, a difference of 1.26 years of schooling between undernourished students and students who are not undernourished is estimated, with an average of approximately seven years of schooling for the undernourished.

Additionally, in the cohort as a whole, it is estimated that 33 out of 100 undernourished children will complete the 12 years of school, while 53 out of 100 students who are not undernourished will complete their secondary education.

3. Productivity-related effects and costs

The schooling differential indicated in the preceding section implies reduced cumulative human capital among the undernourished, with a direct negative effect on productivity.

Added to that are the 30,749 estimated additional deaths as a result of undernutrition in the cohort aged 0 to 59 months old in the 2005-2009 period, which, if their labor potential of 2,400 man hours per year is considered, represents a potential loss of productivity equal to 2.924 billion man hours during their working lives (2015 to 2069).

Based on these data, it is estimated that the economic losses in productivity associated with global undernutrition in the Peruvian population under five would amount to S/.872 million in 2005, equivalent to US$264 million for the same year.41 Of this amount, US$157 million are the consequence of a lower educational level and US$107 million are due to the mortality differential.

Considering the entire period during which these events would occur (2015-2069), the annual cost amounts to S/.70.75 million, equivalent to US$21.4 million. Of this amount, US$12.8 million correspond to costs due to mortality and US$8.7 million represent losses due to less schooling.

These costs result in an annual productivity cost equivalent to 0.027% of GDP and 0.31% of social spending in Peru.

4. Summary of effects and costs

Taken together, undernutrition costs in the cohort of undernourished boys and girls under five in 2005 are estimated at S/.1.139 billion; that is, US$345.7 million.

These results indicate that the loss of human resources due to lower academic achievement and the loss of productive hours (MH) due to mortality account for the majority of the estimated cost of undernutrition, 45% and 31%, respectively.

Table 1.2
Summary of results:
Effects and costs of global undernutrition in the 0- to-59 month cohort. Peru, 2005.

<table>
<thead>
<tr>
<th></th>
<th>Units</th>
<th>Costs (Present value)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Millions of nuevos soles</td>
</tr>
<tr>
<td>HEALTH</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increased cases of morbidity</td>
<td>433.227</td>
<td>257.9</td>
</tr>
<tr>
<td>Number of additional deaths</td>
<td>30.749</td>
<td></td>
</tr>
<tr>
<td>EDUCATION</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Additional repeated school years</td>
<td>20.371</td>
<td>10.9</td>
</tr>
<tr>
<td>Desertion differential</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PRODUCTIVITY</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loss of MH due to mortality</td>
<td>2,923,771.002</td>
<td>352.9</td>
</tr>
<tr>
<td>Fewer years of schooling</td>
<td>1.3</td>
<td>517.6</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.139,3</td>
</tr>
</tbody>
</table>

Source: prepared in-house
III. Scenario analysis: costs and savings

Based on the costs estimated for Peru, as a consequence of the prevalence of global undernutrition in the population under five in 2005, it is possible to project different scenarios. The results of simulations corresponding to three scenarios for trends in undernutrition and its effects on costs for 2015 are presented below.

The scenarios considered are the following:

1. As of 2015, the latest figures available on the prevalence of global undernutrition used in this study remain stable (see Table 2).

2. In 2015, the target established in the Millennium Development Goals (MDG) of decreasing global undernutrition by half of the prevalence in 1990 is reached. This implies progressive reduction until a rate of 5.8% among children under age five is attained, which would mean an average annual reduction of approximately 0.22 percentage points.

3. By 2015, global undernutrition is eradicated in the country, which for the purposes of this analysis is equivalent to a prevalence of 2.5%, representing the “normal” proportion of cases according to the measurement parameters used by the National Centre for Health Statistics (NCHS). In order to achieve this, an annual reduction greater than 0.5 percentage points would be required.
Figure 12 illustrates how a progressive reduction in the prevalence of global undernutrition also generates a steady decline in the costs associated with it. If the prevalence remains constant (scenario 1), given that Peru has a tendency to reduce the size of the cohort of children aged 0 to 4 years, the costs in 2015 will drop by 2.2%. If the goal pertaining to the MDG is achieved (scenario 2), the costs of global undernutrition in 2015 will decrease by US$266.4 million.43 If global undernutrition is eradicated (scenario 3), the costs will drop even further, amounting to a current value of US$126.86 million as of 2015.

Table 13 presents a comparison of the estimated costs for 2005 and those projected for each scenario as of 2015. That table shows that the largest variation in costs corresponds to productivity and health care.

Based on the cost trends presented, it is possible to estimate the potential savings generated from the time the actions aimed at achieving the established goals begin.
The distances between the trend lines in Figure 12 – scenario 2 with regard to scenario 1, and scenario 3 with regard to scenario 1 – illustrate the savings that would be generated from year to year, accumulating until 2015 to the extent that progress is made toward reducing or eradicating undernutrition. These savings, stated at the present value for 2005, equal US$245 million and US$814 million for scenarios 2 and 3, respectively. Of these savings, 36% and 40%, respectively, would be obtained from the impact generated in the first half of the process (2006-2010).

This implies that not only could costs in 2015 be significantly lower, but also that significant savings could be obtained throughout the process to achieve the goal established for each scenario. If adequate policies remain in force, the projected benefits could continue to accumulate after 2015.

The preceding information reflects the economic benefits of progressing toward the eradication of undernutrition. All effective programs in this area would make a positive impact on the quality of life of individuals and result in significant savings to society.
ANNEXES
Information Sources

• Banco Central de Reserva del Peru (Central Reserve Bank), Annual Report 2006
  www.bcrp.gob.pe/bcr/Memoria-Anual/Memoria-Anual.html

• World Bank, World Development Indicators, 2005

• Celade, ECLAC Population Division, Population forecasts

• ECLAC, social expenditure database

• ECLAC, exchange rate database

• National Demographic and Health Survey (Endes) 1996; 2000; 2004; 2005

• Instituto Nacional de Estadística e Informática (INEI/National Institute of Statistics and Informatics),
  Survey of Permanent Employment in Metropolitan Lima (EPE), 2005

• Instituto Nacional de Estadística e Informática (INEI/National Institute of Statistics and Informatics),
  National Survey of Families (ENAHO), 2003; 2004

• Ministry of Economy and Finance, Multi-annual Macroeconomic Framework 2005-2007
  www.mef.gob.pe/ESPEC/marco_macro.php

• Ministry of Economy and Finance (MEF), Financial Administration System (SIAF)
  http://ofi.mef.gob.pe/transparencia/default.aspx

• Ministry of Education, National Height Census of Students in First Grade of Primary School, Peru, 2005

• Ministry of Health, General Office of Statistics and Informatics Database

• Ministry of Health, Reports from the National Maternal-Perinatal Institute, 2006

• Ministry of Health, Nutritional State Information System (SIEN), Consolidated 2005

• World Health Organization (WHO), Statistical Information System, 1979-2004

• World Health Organization (WHO), Global Database on Child Growth and Undernutrition
  www.who.int/gdgm/p-child_pdf

• National Food Assistance Program (Pronaa), Institutional Operating Plan 2005

• National Food Assistance Program (Pronaa), Consultancy Report “Reform and Merger of Nutritional
  Programs, design of the Comprehensive Nutrition Program”

• Interviews with national health sector specialists
- Alderman H, Behrman J. (2004), *Estimated economic benefits of reducing low birth weight in low income countries* 
  World Bank, Washington

- Andraca, Isidora de; Marcela Castillo; Tomás Walter (1997). *Desarrollo psicomotor y conducta en lactantes anémicos por deficiencia de hierro (Psychomotor development in infants with iron deficiency)* In: Desnutrición Oculta en América Latina: Deficiencia de Hierro (Hidden Undernutrition in Latin America: Iron Deficiency) CESNI (Centro de Estudios Sobre Nutrición Infantil/Center for Studies on Child Nutrition) document


- Celade (2004), Boletín Demográfico (Demographic Bulletin) No. 73. América Latina y El Caribe: Estimaciones y proyecciones de población 1950-2050 (Latin America and the Caribbean: population estimates and forecasts 1950-2050), ECLAC


- ECLAC (2004), *Anuario Estadístico de América Latina y el Caribe (Statistical Year Book for Latin America and the Caribbean)*, Santiago de Chile


- ECLAC – WFP (2005), *Hambre y desigualdad en los países andinos: la desnutrición y la vulnerabilidad alimentaria en Bolivia, Colombia, Ecuador y Perú (en prensa), Serie Políticas Sociales No. 112 (Hunger and inequality in the Andean countries: undernutrition and food vulnerability in Bolivia, Colombia, Ecuador and Peru, Social Policies Series No.112)* ISBN 92-1-322780-9, Santiago de Chile


- ECLAC, *Panorama Social 2006 (Social Outlook 2006)*


- DerSimomian R. and Laird N. (1986), *Meta-Analysis in Clinical Trials, Controlled Clinical Trials 1986; 7: 177-188*


- Ivanovic, Danitza (2005), *Factores que inciden en la permanencia del educando en el sistema educacional, en el marco de un estudio de seguimiento. Región Metropolitana, Chile, 1987-1998 (Factors with an impact on remaining in the educational system, within the framework of a follow-up study, Metropolitan Region, Chile 1987-1998)* INTA, Universidad de Chile, database reprocessed by ECLAC
• Ivanovic, Danitza et al (2000). Long-term effects of severe under nutrition during the first year of life on brain development and learning in Chilean high-school graduates, Nutrition 16: 1056-1063

• WHO / PAHO (2003), “Estadísticas de Salud para las Américas” (Health Statistics for the Americas), Washington


• ORC Macro (2005), MeasureDHS www.measuredhs.com


• World Health Organization (2004), Comparative quantification of health risks, global and regional burden or disease attributable to selected major risk factors, Edited by M. Ezzati, A. López, A. Rodgers and C. Murray, Geneva
1. Instituto Nacional de Estadística e Informática (National Institute of Statistics and Informatics), Report on the National Demographic and Health Survey, 2005, Lima 2005

2. ECLAC, Social Development Division, public social expenditure database

3. Values updated to 2005, with an annual discount rate of 8%

4. Values updated to 2005, with an annual discount rate of 8%

5. Equivalent to a 2.5% reduction in prevalence

6. According to 2006 WHO standards

7. According to 2006 WHO standards


9. Desnutrición Infantil en América Latina y el Caribe (Child Undernutrition in Latin America and the Caribbean), Boletín Desafíos (Challenges Bulletin) Number 2, April 2006 - ISSN 1816-7527

10. The countries of Latin America and the Caribbean are considered as a region.

11. According to the WFP, food vulnerability is the probability of an acute decline in food access or consumption.

12. Desnutrición Infantil en América Latina y el Caribe (Child Undernutrition in Latin America and the Caribbean), Boletín Desafíos (Challenges Bulletin) Number 2, April 2006 - ISSN 1816-75

13. Martínez, R. (2005), Hambre y desigualdad en los países andinos. La desnutrición y la vulnerabilidad alimentaria en Bolivia, Colombia, Ecuador y Peru (Hunger and inequality in the Andean countries, Undernutrition and food vulnerability in Bolivia, Colombia, Ecuador and Peru) (42-46) Santiago de Chile, ECLAC, United Nations


15. Follow-up indicator on the goal related to hunger in the Millennium Declaration


17. Idem.

18. Since 1997, the export growth rate has exceeded the GDP growth rate, reaching peaks of nearly 15% in the years 2004 and 2005. Source: Banco Central de Reserva del Peru (Central Bank of Peru)

19. The Gini coefficient is used to measure inequality in income in a country. It is a number between 0 and 1, where 0 corresponds to perfect equality (everyone has the same income level) and 1 is perfect inequality (one person receives all of the income and the others have none). ECLAC, Panorama Social en América Latina (Social Outlook for Latin America), 2006

20. Panorama Social en América Latina (Social Outlook for Latin America), 2006

21. ECLAC, Panorama Social en América Latina (Social Outlook for Latin America), 2006

22. Instituto Nacional de Estadística e Informática (National Institute of Statistics and Informatics), Report on the National Demographic and Health Survey (Endes) 2005, Lima 2005

23. Very small at birth; children who are 3 SD or more below the median; with a birth weight of less than 2,500 grams.

24. Weight-for-age is a general indicator of undernutrition that does not differentiate chronic undernutrition, which is due to structural factors of society, from acute undernutrition, which corresponds to recent weight loss. It is very useful for detecting changes in the nutritional state of children who are being seen on a continual basis.
ECLAC, Social Development Division: http://www.cepal.org/dds/GastoSocial/datos.htm

Speech made by the current President of the Republic of Peru, July 2006

Design of the Comprehensive Nutrition Program, Agreement between Mimdes/Pronaa-WFP, Author: Mónica Saavedra Chumbe

For further details on the theoretical and methodological framework supporting these estimates, see “Modelo de análisis del impacto social y económico de la desnutrición infantil en América Latina” (Model for the analysis of the social and economic impact of child undernutrition in Latin America), ECLAC 2006

The estimates of effects and costs presented in this report correspond to averages and are subject to the same margins of error as the original sources.

DP represents the greater probability among the undernourished of having a pathology (i) as a “consequence” of undernutrition.

Source: Ministry of Health, Sistema de Información del Estado Nutricional (SIEN/Information System on Nutritional Status), Consolidated 2005

Total reference population: Population of those who died from causes linked to undernutrition

For purposes of comparing cost estimates in this study, the population aged 15 to 64 years is defined as the WAP.

In the case of the public sector, indicators were estimated based on information reported by different organizations pertaining to the Ministry of Health. To estimate private-sector costs, the official minimum salary, the fare for public urban transportation and supplies not covered by the public health system were used.

ECLAC, Anuario estadístico de América Latina y el Caribe (Statistical year book on Latin America and the Caribbean), 2006

In order to estimate the education gaps caused by undernutrition, the estimates made for a longitudinal study conducted in Chile from 1987 to 1998 (Ivanovic 2005) were adapted. According to these estimates, in populations that were socioeconomically similar, individuals who had suffered from undernutrition in their preschool phase have a risk of repeating (a school year) equivalent to 1.65 times that of individuals who had not been undernourished. In the absence of estimates and considering the characteristics of the educational systems, in order to have estimates that were comparable between Andean countries, this relative risk for repeating school years and a desertion differential of 1.4 over the educational cycle were used.

All of the estimates for the cohort of children aged 0 to 4 years in 2005 have a progressive reduction process until 2009, as its members become older.

With an annual discount rate of 8%

Ibidem.

For forecasts, the education coverage of the school-age population and the educational levels attained by the 20-to-24-year-old cohort listed in the most recent household survey (2003) are used.

Considering an annual discount rate of 8%

Value updated to 2015, with an annual discount rate of 8%

Value updated to 2015, with an annual discount rate of 8%

Value updated to 2005, with an annual discount rate of 8%