Economic Cost of Undernutrition

Submitted to

DFID Pakistan

March 13, 2012

By

Institute of Public Policy
Beaconhouse National University, Lahore

Social Policy and Development Centre, Karachi
and
Macroeconomic Insights, Islamabad

ECONOMIC COST OF UNDERNUTRITION

Undernutrition is one of the greatest, although one of the least recognized, challenges that face Pakistan today. It is one of the primary causes of mortality, especially among children. Therefore, in order to focus the attention of policy makers on this problem it is essential to quantify the cost of undernutrition to the economy.

World Bank estimates that GDP losses arising from undernutrition run as high as 2-3 percent. In absolute terms, given the size of Pakistan's economy, this is equivalent to a loss in 2011 of Rs 360 billion (£2.6 billion) to Rs 540 billion (£3.9 billion). As such, improving nutrition is as much an economic issue as a welfare, social protection and human rights one.

The objective of this short study is to estimate the economic cost of undernutrition to Pakistan. Section 2 gives the prevalence levels of different measures of undernutrition in each province and for the country as a whole, as revealed by the National Nutrition Survey (NNS) of 2011.[1] Section 3 discusses the different approaches that have been used for quantifying the costs of undernutrition and highlights the approaches chosen by us, in light especially of data availability. Section 4 gives the values of demographic and economic parameters which are required for the estimation exercise. Section 5 presents the key magnitudes related to the impact of undernutrition. Section 6 gives the resulting estimates of the economic cost of undernutrition for each province and for Pakistan as a whole, followed in Section 7 by sensitivity analysis of these estimates. Finally, in Section 8 we present the key conclusions and highlight some policy implications.

2 PREVALENCE OF UNDERNUTRITION

Stunting rate (low height for age): The prevalence of stunting among children below the age of five years is estimated at over 66 percent for the country as a whole, as shown in Table A.1 in the Appendix. Severe and moderate stunting is observed in 43 percent of the children. The highest incidence of stunting is in Balochistan of 71 percent followed by Sindh at 69 percent.

Wasting Rate (low weight for height): Table A-2 shows that the overall prevalence of wasting among children below five years is close to 17 percent, with the highest rate in Sindh at over 19 percent.

Underweight (low weight for age): This is one of the indicators in the Millennium Development Goals (MDGs) and is considered as a composite measure of nutritional status. According to Table A-3, over 31 percent of children below five years are underweight. Here also, the highest rates are observed in Balochistan and Sindh of 42 and 40 percent respectively. Khyber-Pakhtunkhwa has a significantly lower prevalence rate of 25 percent, while Punjab is close to the national rate.

Table A-4 reveals that the prevalence rates of different measures of undernutrition generally declined between the late 70s and the late 90s. A comparison, however, of the findings of the NNS 2001 with the NNS 2011 shows that stunting and wasting rates have risen significantly during this period while the prevalence rate of underweight children has remained, more or less, unchanged.

Table A-5 makes a comparison of prevalence rates among South Asian countries. Pakistan has a relatively high stunting rate, lower only than Afghanistan. The wasting rate is higher than Pakistan in Bangladesh and India, while Pakistan has relatively low prevalence of underweight children.

We turn now to micronutrient deficiencies.

Iron deficiency: As shown in Table A-6, over one third of the children nationally have iron deficiency, with the highest incidence of over 36 percent in Punjab and the lowest in Khyber-Pakhtunkhwa at 13 percent.

Vitamin A deficiency: The prevalence of vitamin A deficiency is high at 56 percent for the country as a whole. Here again the incidence is highest in Balochistan at over 80 percent, as given in Table A-7.

[1] The NNS 2011 has not yet been officially released. The results of the survey have been brought out recently by Aga Khan University, Pakistan Medical Research Council and Nutrition Wing, Cabinet Division, GOP.

3 METHODOLOGY FOR QUANTIFICATION OF COST

World Bank [2006] has indicated that undernutrition slows economic growth in the following ways:

(i) losses in productivity from poor physical status
(ii) losses from cognitive function and deficits in schooling
(iii) losses owing to increased health care costs.

Different approaches have been adopted for quantification of these losses as described below.

DALYs

One way of deriving the cost of undernutrition is to adopt the Disability Adjusted Life Years (DALYs) approach. DALY is expressed as number of years lost due to ill-health, disability or early death. As such, mortality and morbidity are combined into a single metric. Accordingly, DALYs are the sum of YLL, years of life lost due to morbidity and YLD, years lived with disability. DALYs are calculated for different conditions, including undernutrition, and diseases by the World Health Organization (WHO) and also reported by the World Bank. Future years are discounted in this approach.

Bhandari and Zaidi [2004] have used the DALY approach to estimate the cost of undernutrition in India in 2000. They estimate that, if discounting of the future is removed, the magnitude of DALYs lost due to undernutrition was 10 million. They then adjust this number for the labor force participation rate. Next, the resulting estimate of DALYs is multiplied by the Net National Product (NNP) per worker to yield the productivity loss due to undernutrition.

Adoption of this approach leads to an estimate of the cost of undernutrition in India of Rs 103 billion in 2000, equivalent to 0.5 percent of the GDP for that year. However, Bhandari and Zaidi [2004] do not recommend the use of DALYs data as they believe that it does not capture the extent of loss due to undernutrition.

Estimation of Productivity Loss

World Bank [2006] has used this alternative approach for quantifying the cost of undernutrition in Sri Lanka. It essentially involves direct estimation of productivity losses, rather than via DALYs. An assumption is made of the lifetime loss of productivity or earnings of 10 percent by an undernourished person after he/she joins the labor force. Based on this estimate and (a) taking only the children affected by protein-energy malnutrition, (b) using a 3 percent time discount rate, (c) assuming a 12.5 years delay before the beginning of productivity at age 15 continuing to the age of 60 years and (d) assuming average productivity is equal to the GDP per capita, the present value of life time loss of productivity of children who are undernourished today is estimated.

The resulting estimate is US $1.1 billion for Sri Lanka in 2005. This is equivalent to 4.6 percent of the GDP that year. The World Bank [ibid] states that the estimate would be even larger if existing micronutrient deficiencies were also factored in.

However, the World Bank methodology essentially focuses on the productivity loss of children who survive undernutrition and join the labor force subsequently with higher levels of morbidity and cognitive losses. The methodology also requires inclusion of income losses of children who die due to malnutrition before attaining the age of five years.

Bhandari and Zaidi [2004] have used a variant of this approach. This involves estimation of the current productivity loss rather than the present value of future productivity losses. This requires estimates of the prevalence of different forms of undernutrition and micro nutrient deficiencies in adult males and females who are currently members of the labor force. This approach leads to an estimate of the cost of undernutrition in India as high as 4.75 percent of the GDP.

We have essentially adopted the World Bank [ibid] approach, supplemented by inclusion of the income loss of children who do not survive due to undernutrition beyond the age of five years. The Bhandari and Zaidi [ibid] approach could not be used to derive a current estimate of productivity loss because of lack of information on the prevalence of undernutrition in the adult population of Pakistan, especially males. However, we also highlight the results of application of the DALYs approach in Pakistan.

4 DEMOGRAPHIC AND ECONOMIC PARAMETERS

Application of the above methodology requires estimation of a number of demographic and economic parameters as follows:

Population of Provinces and Pakistan: According to the Pakistan Economic Survey (PES) the population of Pakistan in 2010-11 is 177.1 million. Excluding Federally Administered Tribal Areas it is 172.9 million. Based on the population distribution among provinces given in the latest Labor Force Survey (LFS) of 2010-11, the estimated population in the province of Punjab (including Islamabad) is 96.7 million; Sindh, 42.7 million; Khyber-Pakhtunkhwa (K-PK), 24.7 million and Balochistan, 8.8 million.

Population of Children below 5 years: The NNS 2011 gives the percentage distribution of households by number of children below the age of five years. This enables derivation of the average number of children below the age of five years per household. Given the average household size from the Household Integrated Economic Survey (HIES) of 2010-11, the population share of children below the age of five years is derived.

Child Mortality: The child mortality rate (of upto 5 years) in Pakistan is estimated at 81 per 1000 in Pakistan, with the corresponding estimate provincewise being 85 for Punjab, 88 for Sindh, 65 for K-PK and 51 for Balochistan from the Pakistan Demographic Survey of 2007. This mortality rate relates to the probability of a child born today dying before the age of 5 years. What we need is the mortility of children upto the age of five years given the age distribution of children below five years, as given in the NNS 2011. This yields an estimate that about 3.1 percent of the population of children in Pakistan will not survive beyond the age of five.

Labor Force Participation Rate (LFPR): The labor force participation rate in 2011 is given in the latest LFS. It has been rising gradually, especially due to increased entry of women in the labor force. We focus on participation rates for population aged 15 years and above, and ignore child workers. The projected overall LFPR for Pakistan in the next fifteen years or so is close to 58 percent, with 59 for Punjab; 60 for Sindh; 49 for K-PK and 54 for Balochistan. The long term unemployment rate is assumed as six percent.

Income per Worker: Different approaches have been adopted for estimating income per worker. World Bank [ibid] uses per capita income as the relevant indicator. Bhandari and Ziadi [ibid] prefer the NNP per worker. In the Pakistani context, the latter is almost three times the former. It overstates the earnings per worker as it includes a large component of capital income. We have opted for the earned income per worker as reported in the HIES, adjusted for the somewhat higher prevalence of malnutrition in rural areas. This is close to per capita income per annum. The resulting estimates of income per worker are Rs 101,600 per annum in Punjab; Rs 101,200 in Sindh; Rs 90,500 in K-PK and Rs 112,600 in Balochistan.

Growth in Incomes: According to the HIES of 2001-02 and 2010-11 respectively. The real growth of income per worker was 3.3 percent during this period. We have assumed the future long-term growth rate of 3 percent. It is interesting that Bhandari and Zaidi [ibid] have assumed that the growth rate of income per worker will be 7-8 percent, given the substantially higher GDP growth rate of the Indian economy currently compared to Pakistan.

Rate of Time Discount: World Bank [ibid] assumes a time discount rate of only 3 percent in the Sri Lankan study. Bhandari and Zaidi [ibid] assume a discount rate of 7-8 percent in the Indian case. Given the somewhat 'myopic' view of planners and policy makers in Pakistan, we have assumed higher rate of time discount of 10

percent. This is clearly on the conservative side and will reduce significantly the present value of the income/productivity losses.

5 KEY MAGNITUDES

Quantification of the cost of undernutrition requires estimates of some key magnitudes related to the impact of undernutrition, as follows:

Prevalence of undernutrition: The measure used is the prevalence of underweight children below the age of five years. As highlighted earlier, this is the prime composite indicator of nutritional status and is used to capture malnutrition in the MDGs. The resulting estimate of the cost of undernutrition is likely to be understated because of lack of accounting of the costs due to other micronutrient deficiencies. In the DALYs approach, however, these costs are also allowed for.

Deaths due to undernutrition: World Bank [2006] reports that half of all child deaths are due to undernutrition. DFID [2011] states that one third of these deaths are due to undernutrition. Horton [1999] estimates that in India almost 62 percent of child deaths are due to malnutrition. Therefore, there is significant variation in these estimates. We have assumed a somewhat conservative estimate of 40 percent.

Extent of Productivity loss: World Bank [ibid] generally assumes that the extent of productivity loss of undernutrition, including the impact of cognitive factors, is 10 percent. Bhandari and Zaidi [ibid] assume losses in the range 10-15 percent due to different micronutrient deficiencies. We assume the same extent of the loss as World Bank of 10 percent.

6 ESTIMATED COST OF UNDERNUTRITION

Based on the above assumptions and application of the methodology, first, of DALYs and, second, of direct estimation of income losses described in Appendix 2, we arrive at the following estimates of the costs of undernutrition.

DALYs

WHO [2009] estimates of DALYs in Pakistan are given in Table 1. The total DALYs lost due to undernutrition were over 2.8 million in 2004. Projecting upto 2011, after allowing increase in population and rise in the prevalence of malnutrition, leads to an estimate of 3.4 million DALYs lost. Based on average income per life year of Rs. 102,500 and a labour force participation rate of 58 percent, an estimate of the cost of undernutrition in Pakistan is Rs. 202 billion. This is equivalent to 1.1 percent of the GDP. As highlighted by Bhandari and Zaidi [ibid] this is a very low estimate of the cost of undernutrition and, therefore, not considered a reliable estimate.

Table 1: DALYs estimate for Pakistan* 2004

	('000)
Low Birth Weight	1838
Protein-Energy Undernutrition	510
Vitamin A Deficiency	34
Iron-Deficiency Anaemia	390
Total	**2825**

Source: WHO (2009)
*Estimates not available by Province

Direct Cost of Income Losses

This approach is applied to each Province, yielding estimates of the cost of undernutrition presented in Table 2. The estimated cost of undernutrition emerges as close to Rs. 282 billion in Punjab; 146 billion in Sindh; Rs. 31 billion in K-PK and Rs. 31 billion also Balochistan. For Pakistan as a whole, the cost of undernutrition is derived as Rs. 490 billion (£ 3.5 billion). The income loss of children who survive has a share of 74 percent and the income loss due to children who die has a share of 26 percent.

Table 2: Costs of Undernutrition By Province in Pakistan

(Rs. in Billion)

	Cost of Surviving Children	Cost of Children who Die	Total Cost
Punjab	200.8	81.0	281.8
Sindh	111.3	34.8	146.1
K-PK	22.8	8.5	31.3
Balochistan	26.3	4.5	30.8
Pakistan	**361.2**	**128.8**	**490.0**

Source: Estimated by IPP

Costs of undernutrition in per capita terms and as a percentage of GDP are presented by Province in Table 3. It appears that the cost per capita of undernutrition is higher in Balochistan and Sindh, in line with relatively high prevalence levels highlighted in Section 2. The cost of undernutrition per capita is relatively low in Khyber-Pakhtunkhwa at only 45 percent of the national average. The cost in Punjab is close to the national average.

Table 3: Cost of Undernutrition per Capita and as a percentage of GDP/GPP*

	Cost per Capita (Rs)	Cost as % of GDP
Punjab	2914	2.95
Sindh	3425	2.35
Khyber-Pakhtunkhwa	1268	1.52
Balochistan	3514	4.59
Pakistan	**2835**	**2.71**

* Based on estimates given in Bengali [2005] updated to 2010-11; GPP = Gross Provincial Product.

In terms of cost as a percentage of GDP, the highest level is observed in Balochistan at 4.6 percent and the lowest in Khyber-Pakhtunkhwa at 1.5 percent. For Pakistan as whole the cost of undernutrition is 2.7 percent of the GDP. This is close to the international estimates which range from two to three percent.

7 SENSITIVITY ANALYSIS

As indicated above, our assumptions about the percentage of children below five years who die of undernutrition at 40 percent and the extent of productivity loss at 10 percent are on the conservative side. In addition, we have taken a high rate of time discount of 10 percent.

As such, we undertake sensitivity analysis with somewhat less conservative assumptions of, first, that 50 percent of the children die due to undernutrition in line with the World Bank [ibid], second, that productivity losses on average stand at 12 percent as assumed by Bhandari and Zaidi [ibid] and, third, a lower rate of time discount of 9 percent.

The consequence is that the national estimate of the cost of undernutrition rises to Rs 745 billion (£5.3 billion), equivalent to 4.1 percent of the GDP. The represents an increase of 53 percent on the estimates given in Table 2.

8 CONCLUSIONS AND POLICY IMPLICATIONS

The application of the methodology developed by us which represents an extension of the approach adopted by the World Bank [ibid] indicates that the cost of undernutrition currently in Pakistan ranges from Rs 490 billion (£3.5 billion) to 745 billion (£5.3 billion), depending upon the nature of the underlying assumptions. This is equivalent to 2.7 to 4.1 percent of the GDP. The cost per capita is the highest in Balochistan and Sindh, followed by Punjab and Khyber-Pakhtunkhwa. However, as a percentage of the Gross Provincial Product, the cost is relatively high in Punjab than in Sindh, due to the higher per capita income in the latter.

The estimated costs of undernutrition are high in Pakistan, even under conservative assumptions. This highlights the costs that the people of Pakistan have had to bear in the presence of a benign neglect by policy makers of the losses arising from undernutrition. Such high costs are clearly likely to imply large returns to nutrition interventions in the country. This is the subject of the next study for DFID by IPP on Cost Effectiveness of Undernutrition Interventions.

We also suggest that following the official release of NNS 2011 an aggressive campaign is launched to highlight the high cost of undernutrition in Pakistan in order to create large-scale public awareness and mobilize support for nutrition interventions.

APPENDIX

Table A-1: Stunting* Rates among Children below the age of 5 years

(%)

	Severe	Moderate	Mild	Total
Punjab	17.6	20.8	26.3	64.7
Sindh	26.5	20.8	21.8	69.1
K-PK	25.1	24.1	17.3	66.5
Balochistan	32.2	20.6	18.4	71.2
FATA	35.5	24.3	19.2	79.0
Pakistan	**21.7**	**21.3**	**23.5**	**66.5**

Source: NNS, 2011.

*** Stunting** is prevalence of low height for age. It is determined by standardizing height given age and sex against the international standard of well nourished people, and assigning a Z –Score. Individuals with Z score below – 2 are classified as stunted and below – 3 as severely stunted.

Table A-2: Wasting Rates* among Children below the age of 5 years

	% of Children
Punjab	15.0
Sindh	19.4
K-PK	17.9
Balochistan	18.6
Pakistan	**16.8**

Source: NNS, 2011

***** Severe and moderate wasting. **Wasting** is prevalence of low weight for height. It is calculated by standardizing an individual's weight given – height and sex – against an international standard of well-nourished children. Individuals with Z-scores below – 2 are classified as wasted and Z-scores below – 3 are classified as severely wasted.

Table A-3: Prevalence of Underweight* Children below the age of 5 years

	% of Children
Punjab	30.0
Sindh	39.8
K-PK	25.0
Balochistan	41.8
Pakistan	**31.2**
Rural	33.1
Urban	26.5

Source: NNS, 2011

Severely or moderately underweight. **Underweight** is defined as low weight for age. It is considered as a composite measure of nutritional status, reflecting chronic and transitory nutritional deprivation. It is a MDG indicator. It is expressed as Z score and is calculated by standardizing a child's weight for age and sex against a given set of well-nourished individuals.

Table A-4: Trends in Indicators of Malnutrition (Pakistan)

	Stunting[a]	Wasting[b]	Underweight[c]
NSWP, 1965	49.0	11.0	n.a.
MNS, 1977	43.3	8.6	53.3
NNS, 1985-7	41.8	10.8	47.9
NHS, 1990-4	36.3	11.8	40.0
NNS, 2011	41.6	14.3	31.5
NNS, 2011	43.0	15.8	31.2

Source: NNS. [a] moderate to severe low height for age; [b] moderate to severe low weight for height; [c] moderate to severe low weight for age

Table A-5: Comparison of Prevalence of Malnutrition among children below 5 years in SAARC Countries

(%)

	Moderate and Severe Stunting	Wasting	Underweight
Afghanistan, 2004	54	9	39
Bhutan, 1999	40	3	19
Bangladesh, 2007	36	17	46
India, 2005-06	43	20	48
Maldives, 2001	25	13	30
Nepal, 2006	43	13	45
Sri Lanka, 2000	14	15	29
Pakistan, 2011	**43**	**16**	**31**

Source: NNS, 2011

Table A-6: Prevalence of Iron Deficiency Anaemia* among Children below 5 years

	% **
Province/Region	
Punjab	36.2
Sindh	31.8
K-PK	13.4
Balochistan	22.7
Pakistan	**33.4**
Urban	34.5
Rural	33.0

Source: NNS, 2011

*Severe or moderate iron deficiency, which affects the cognitive ability of children and reduces IQ.

** At the national level, the prevalence of iron deficiency has from 35.5 % in NNS 2001 to 33.4 % in NNS, 2011.

Table A-7: Prevalence of Vitamin A Deficiency * in Children below 5 Years

	%**
Province/Region	
Punjab	52.9
Sindh	57.6
K-PK	77.5
Balochistan	80.7
Pakistan	**56.0**
Urban	50.1
Rural	58.3

Source: NNS 2011

* Severe to mild deficiency <0.70 μ mol/L. Vitamin A deficiency is an essential micro nutrient required for normal vision, growth and development. It is a contributing factor in 2.2 million deaths each year of diarrhea.

** At the national level, it has gone up sharply from 12.6% in NNS 2001 to 56 % in NNS 2011.

REFERENCES

- Bengali K. and M. Sadaqat, 2005, **Provincial Accounts of Pakistan,** Working Paper, Social Policy and Development Centre, Karachi.
- Bhandari L, and Lehar Zaidi, 2004, **Reviewing the Costs of Malnutrition in India,** Indicus Analytics
- DFID, 2011, UK Position Paper on Undernutrition, **Scaling up Nutrition.**
- Horton, S. Ross, 2003, **The Economics of Iron Deficiency,** Food Policy 28: 517-5.
- UNICEF, 1990, **Conceptual Model of Determinants of Child Nutrition and Strategies to address them.**
- World Bank, 2006, The Costs of Undernutrition in Sri Lanka.
- World Bank, 2006, **Malnutrition causes Economic Loss, half of all child deaths.**