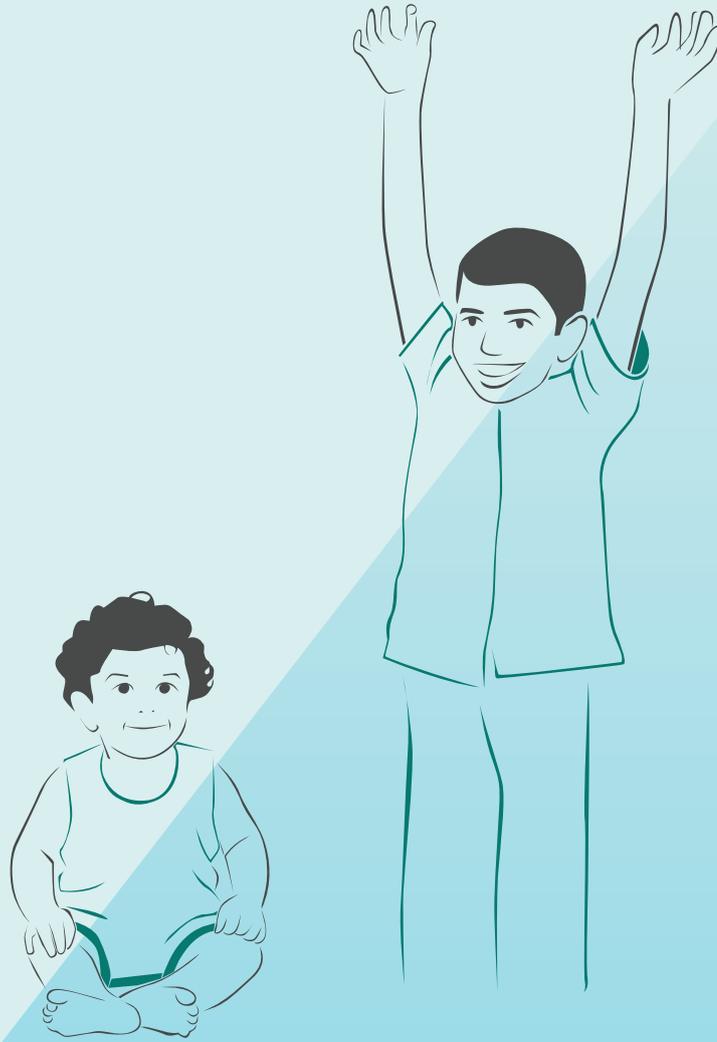


REDUCE CHILDHOOD STUNTING THROUGH MICRONUTRIENT SUPPLEMENTS

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Benefits and Costs of Reducing Childhood Stunting by Providing Micro-Nutrient Supplements from 6 to 59 months



SMARTER SOLUTIONS FOR
BANGLADESH



Nutrition Direct Package for Stunting in Bangladesh:A Benefit to Cost Ratio Analysis

Bangladesh Priorities

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This work has been produced as a part of the Bangladesh Priorities project, a collaboration between Copenhagen Consensus Center and BRAC Research and Evaluation Department.

The Bangladesh Priorities project was made possible by a generous grant from the C&A Foundation.

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Introduction

Nutrition remains a major challenge in the social development of Bangladesh, particularly in the area of stunting. The focus of this paper is on key nutrition direct interventions to address stunting. This paper will show that, according to a cost-benefit analysis, a standard set of nutrition direct interventions offer substantial economic benefits relative to the costs. The paper is outlined as follows: after a description of the international and national contexts for stunting, the paper presents key estimates of the costs and benefits of the interventions, followed by a concluding discussion.

International Context

Stunting is a key health outcome that is linked with a variety of other social and economic development outcomes, particularly when experienced in the first 1,000 days of a child's life. Studies have established a connection between stunting and decreased brain development, lower performance in school, higher morbidity rates throughout life, and lower adult productivity (Victoria et al. 2013). There are also links with future income through several mechanisms. For example, stunting may reduce wages of occupations that require manual labor, decrease the opportunity for higher skilled jobs due to limited cognitive abilities, reduce the years of schooling, and increase health care costs due to chronic diseases associated with malnutrition (Hoddinott et al., 2013).

Stunting was relatively disregarded under the United Nations Millennium Development Goal (MDG). The most relevant goal for nutrition was the MDG 1.8, which calls for halving the rate of underweight children. Although the MDG authors established these targets for the prevalence of underweight children, many nutrition advocates and experts have argued for a focus on stunting (UNICEF, 2013). The measurement of underweight children is a snapshot of hunger, but stunting, however, measures chronic malnutrition (Ibid.).

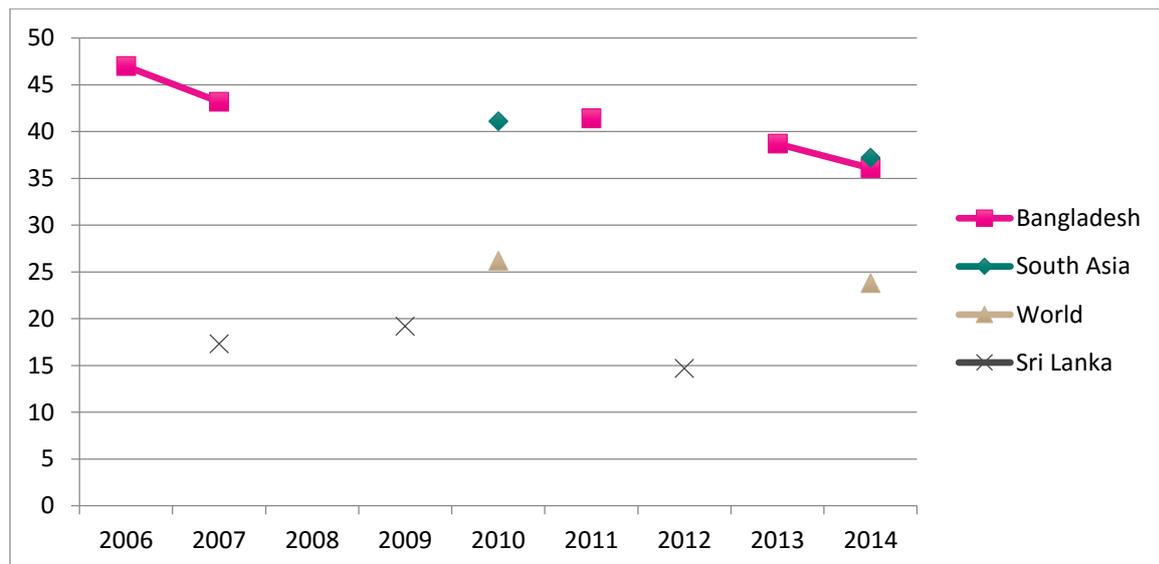
The new Sustainable Development Goals (SDGs) focus more intensely on stunting. The SDG target 2.2 is, "By 2030, end all forms of malnutrition, including achieving, by 2025, the internationally agreed targets on stunting and wasting in children under 5 years of age, and address the nutritional needs of adolescent girls, pregnant and lactating women and older persons."

Bangladesh Context

Bangladesh has experienced a decline in stunting rates over time, though the rate remains high. The rates compared with other countries and regions are presented in Figure 1. 36 percent of children

under 5 are considered to be short for their age or stunted, a decline from 47 percent of children under five in 2006. This is slightly less than the rate for all of South Asia in 2014, at 37.2 percent, but substantially more than Sri Lanka at 14.7 percent (in 2012) and the World average at 23.8 percent in 2014. Meanwhile, 12 percent of children under 5 are severely stunted (below -3 SD) in Bangladesh.

Figure 1. Rates of Stunting Under 5 Years, Various Countries



Source: World Bank Data, 2016.

Within these rates, several trends emerge in Bangladesh according to BDHS (2014). Urban children experience stunting at a lower rate than rural children - 31 percent vs. 38 percent. When broken down by the administrative area of division, stunting rates are the highest in Sylhet at 50 percent and smallest in Khulna at 28 percent. The level of education of the mother is also correlated with stunting; the offspring of mothers with few years of schooling have a higher rate of stunting at 40 percent than children with a mother who has finished secondary or higher education at 29 percent. Meanwhile, differences by wealth quintiles are substantial. Children under five with mothers in the poorest income quintile experience a rate of stunting - 50 percent - much higher than children with mothers in the wealthiest income quintile at 21 percent.

The Interventions

Nutrition direct interventions cover a variety of interventions, ranging from nutritional supplements, fortification, and deworming pills to behavioral change. These interventions range dramatically in their costs, the difficulty in implementation – with behavioral change being the most difficult, and their expected benefits for people. Nutrition indirect interventions include such areas as access to clean water, access to medical attention, and the consumption of healthy foods.

A literature in nutrition has attempted to model the effect of a package of nutrition direct interventions on a variety of health outcomes, particularly infant and child mortality; these interventions also reduce stunting (Bhutta et al., 2013; Bhutta et al., 2008; Horton et al., 2010). The focus of this paper is on stunting outcomes, even though this is not the intention of these interventions.

Under the particular treatment analyzed in this paper, a bundle of nine nutrition direct interventions are included primarily during two stages, pregnancy and infants/ children. During pregnancy, the main intervention is multiple micronutrient supplementation (including iron- folic acid supplementation). During infancy and early childhood, another seven interventions are exclusive breast-feeding education, complementary feeding education, provision of complementary foods (such as balanced energy and protein), vitamin A supplementation (6–59 months old), multiple micronutrients, management of severe acute malnutrition (SAM), and zinc supplementation. The package overall includes salt iodization.

Within the National Nutrition Service (NNS) strategic plan, eight of ten of these interventions have already been included. These are folic acid supplementation, multiple micronutrient supplementation, calcium supplementation, exclusive breast feeding, complementary feeding, vitamin A supplementation (6–59 months old), SAM management and MAM management. The two interventions that do not appear in the NNS plan are preventive zinc supplementation and the provision of complementary foods (such as balanced energy protein supplementation).

Cost and Benefit Sources of Data and Method

The price of the package of interventions was USD \$97.11 in 2010 (Horton and Hoddinott, 2013).¹ This price was converted to BDT according to the 2010 exchange rate, then increased by the inflation of Bangladesh from 2011 to 2015. By using this cost data, we assume that the prices roughly follow the international price.² The cost also does not include concerns with building the institutional capacity of relevant institutions involved in the execution of the interventions, which varies in their difficulty.³

In terms of benefits, this paper focuses on the effects of this package of interventions on stunting, and therefore income. However, the package of interventions in this treatment improves health through a wide variety of mechanisms. For example, included among the micronutrients are iron supplements, which then reduce the incidence of anaemia and therefore maternal mortality.

In terms of data, the effect of stunting on income, the analysis uses the 66 percent wage difference that was found in an empirical study in rural Guatemala (Hoddinott et al., 2011). This estimate was with a small modification subsequently used in several papers (Hoddinott et al., 2013; Hoddinott & Horton, 2013). The approach to wages was also used in earlier work (Behrman et al. 2004). To calculate wages, the analysis assumes a working age of 18 (the age at which adolescents complete secondary school) and 60. The analysis uses a wage estimate of BDT 147,630 in 2015.

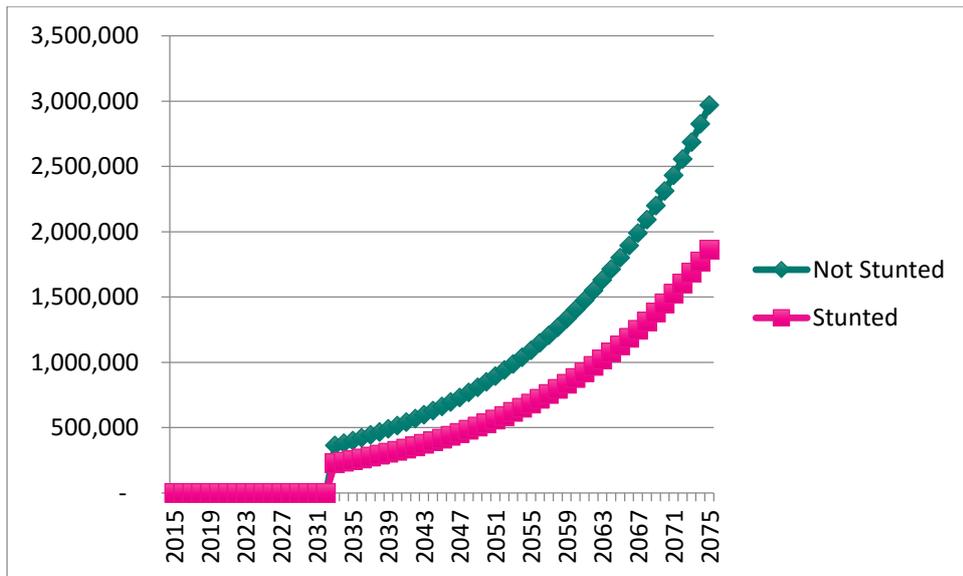
Here, we assume that real wages increase by the average GNI per capita increase from 2005-2014, 5.13%.

¹ The cost estimate for Horton et al. (2013) was actually for a package of 13 interventions that included the ten presented in this calculation.

² We assume that this cost is the same for the whole population, though earlier work (Horton et al., 2010) assumes that this price applies only to the first 80 percent of the population, and increases substantially thereafter.

³ Furthermore, the standard price does not recognize the increased cost involved in reaching relatively more difficult to reach population; the current reductions in stunting can reasonably be assumed to result from programs that target easy to reach populations with less costly interventions.

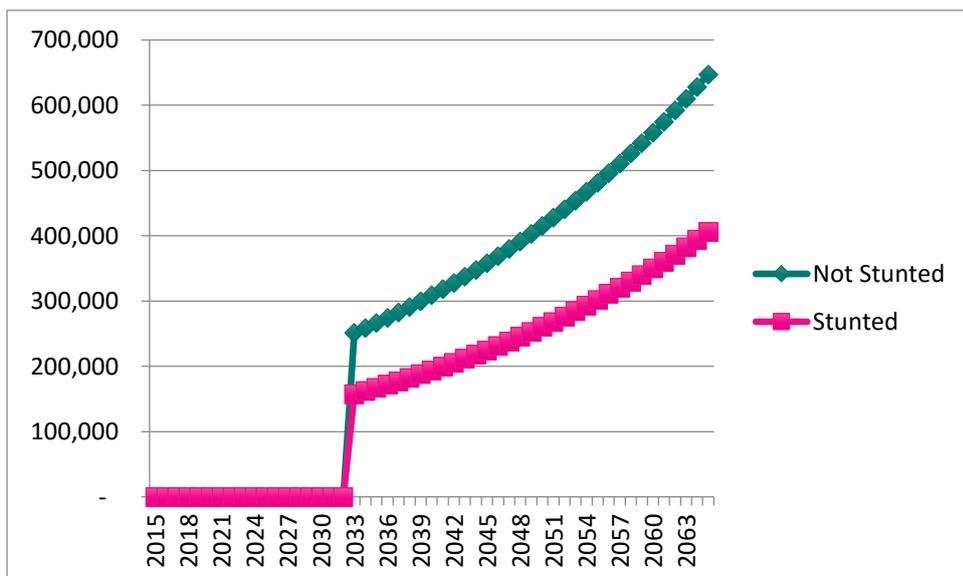
Figure 2. Path of Wages of Stunted and Not Stunted Individuals, in BDT, 5.13% Growth



Source: Author calculations.

The difference in wages between not stunted and stunted individuals is substantial under the wage growth rate of 5.13 percent. According to Figure 2, the average annual wage of the 18 year old in 2033 is BDT 903,819 for a not stunted individual, vs. 567,013 for a stunted person. For the working life of 18 to 60 years old, the total difference in wages earned is over BDT 20 million, or an average of over BDT 336,000 per year.

Figure 3. Path of Wages of Stunted and Not Stunted Individuals, in BDT, 3% Growth



Source: Author calculations.

As a sensitivity analysis, we will also analyze the impact of assuming a much lower real wage growth rate of 3 percent. According to Figure 3, the average annual wage of the 18 year old in 2033 is BDT 251,330 for a not stunted individual, vs. 157,673 for a stunted person. For the working life of 18 to 60 years old, the total difference in wages earned is over BDT 8 million, or an average of over BDT 186,000 per year.

In terms of the effectiveness of the package of interventions, the effect on stunting is estimated at 20.3 percent (Bhutta et al., 2013), a rate that has been used elsewhere (Horton and Hoddinott, 2014). This effectiveness estimate is significantly lower than the previous estimate of effectiveness of 35.5% (Bhutta et al., 2008), used in the previous Copenhagen Consensus estimates.

The rate of stunting among Bangladeshi children under 5 in 2014 was 36.1 percent (World Bank, 2016), meaning that if the intervention is applied to the entire population, the level of stunting will decrease by an estimated 7.3 percent ($36.1\% \times 20.1\%$).

The economic benefits of the package is then estimated as the net present value of the future increased earnings from not being stunted, using discount rates of 3%, 5% and 10%.

There are a number of assumptions built into this approach. First, we assume a standard international effect of the package on stunting. However, given the reduced rate of stunting, it is unclear how much the approach is responsible for the reductions in the rate of stunting, which may reduce the overall effectiveness rate of the intervention. The wage of the not stunted individual is assumed to be equivalent to the average wage overall. The analysis also assumes that the wage differential established in a study in Guatemala between stunted and not stunted individuals is applicable to Bangladesh. Finally, we assume that the package was implemented in 2015, and track the growth in wages as such.

Benefit to Cost Ratios

The benefit to cost ratio (BCR) for this package of interventions yields positive results according to the analysis, though it is highly dependent on the discount rate. The results are presented in Table 1, with the assumption that wages will continue to grow as the average growth in GNI per capita over the past 10 years, at 5.13%. For a 3 percent discount rate, the BCR is 41.92; in other words, for every taka spent, the net economic benefit in its present value is 41.92 taka. The result differs for the discount rate of five percent. In this case, every taka spent yields an economic benefit of 18.81 taka. The lowest return is from a discount rate of 10 percent, with just 3.41 taka NPV return for every taka spent. Clearly, these results are highly sensitive to the discount rate used, both because of the long period of 18 years until the individual begins to earn and the benefits accrued all the way through a working life.

Table 1. Main BCR of a Nutrition Direct Package in Bangladesh, with average 5.13% Real Wage Growth

	Discount rate		
	3%	5%	10%
NPV (BDT)	411,959	184,885	33,515
Cost (BDT)	9,827	9,827	9,827
BCR	41.92	18.81	3.41

Source: Author calculations.

As a sensitivity analysis, we also look at the BCRs when assuming a much lower 3% average real wage growth rate. This analysis appears in Table 2 below. For a 3 percent discount rate, the BCR is 18.27; in other words, for every taka spent, the net economic benefit in its present value is 18.27 taka. The result differs for the discount rate of five percent. In this case, every taka spent yields an economic benefit of 8.71 taka. The lowest return is from a discount rate of 10 percent, with just 1.80 taka NPV return for every taka spent.

Table 2. Sensitivity analysis, BCR of a Nutrition Direct Package in Bangladesh, with 3% Real Wage Growth

	Discount rate		
	3%	5%	10%
NPV (BDT)	179,575	85,597	17,702
Cost (BDT)	9,827	9,827	9,827
BCR	18.27	8.71	1.80

Source: Author calculations.

Discussion and Conclusion

According to the benefit to cost ratio analysis presented in this paper, an investment in a package of nine nutrition direct interventions is sensible as a means of reducing stunting and thereby increasing income. The paper presents the main analysis with a 5.13% real wage growth rate, and a sensitivity analysis of 3% real wage growth rate. In the main analysis, with a growth of wages of 5.13 percent and a three percent discount rate, a one taka investment yields 41.92 taka of economic benefit to the country. Even according to a five percent discount rate, a one taka investment yields a 18.81 taka return. The ten percent discount rate, however, yields only a 3.41 taka return on the investment. In the sensitivity analysis with a real wage growth rate of 3%, and a three percent discount rate is used, a one taka investment yields 18.27 taka of economic benefit to the country. With a five percent discount rate, a one taka investment yields a 8.71 taka return. The ten percent discount rate yields just 1.80 taka as return on the investment.

However, there are several observations relevant to the analysis. First, the analysis only focuses on stunting and not a variety of other potentially helpful outcomes, such as reduced infant, child and maternal mortality from such factors as anaemia and low birthweight. All other things equal, this means the BCRs are conservative. Second, the analysis is sensitive to the discount rate, with the lower discount rate of three percent obviously offering the highest return. This is particularly true for these interventions, as the income is generated by the not stunted individuals only at 18 years after the treatment of interventions. Third, as the stunting rate of Bangladesh declines, the overall effectiveness of the intervention would increase greatly if it can target individuals most likely to be stunted. For example, stunting is most prevalent in Sylhet (50 percent) and lowest in Khulna (28 percent). Running a program of these interventions in Sylhet would yield a much higher benefit to cost ratio.

There are a number of challenges to the implementation of nutrition direct interventions, however, that the analysis does not take into account. Execution of the nutrition specific interventions, such as those proposed under this package of interventions, has faced a number of challenges (Rose et al., 2014; Saha et al., 2015). These include frequent changes in the institutional approaches over recent decades, with the current approach of 'mainstreaming' nutrition into the chief health directorates. The efforts are also impeded by poor capacity, insufficient staffing, and low level of spending of the current budget of the NNS in the Ministry of Health and Family Welfare (MoHFW). In implementation at the local level, the principal point of nutrition direct service delivery is currently the community clinic, which faces a number of difficulties in implementing nutrition direct interventions as well, due to challenges in staffing, capacity, oversight and other changes.

Further research is needed on this topic, particularly among existing nutrition programs. Estimates based on local programs can more precisely identify the costs, as they would better judge prices of the local products available, as well as administrative costs. Similarly, the benefits are sensitive to the labor market and a host of other local factors. Finally, local organizations could better estimate the costs of targeting relative to the increased benefits from the program, which may yield much higher NPV of investments.

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