Copenhagen Consensus 2008 Perspective Paper

Malnutrition & Hunger

By

Anil B. Deolalikar

May 10, 2008

A. Introduction

1. The Challenge paper does a very good job of presenting the major malnutrition problems facing the developing world and then discussing the different interventions that have been typically deployed to address these problems. The paper pulls together data on the cost-effectiveness of various nutritional interventions from the literature, and then calculates benefit-cost ratios for these interventions under alternative assumptions about the discount rate and disability-adjusted life years (DALY) saved. It finds that interventions that target micronutrient deficiencies (either through supplementation or food fortification), as well as deworming interventions, have the highest benefit-cost ratios of any nutritional intervention, followed by breastfeeding promotion. The paper concludes that community nutrition interventions, which address protein-energy malnutrition (PEM) among children primarily via food supplementation, are cost-effective but only when they are well-designed and efficiently operated. In general, though, the paper concludes that these interventions are more expensive than micronutrient and deworming interventions.

2. The Challenge paper is an impressive survey of the literature on the prevalence of malnutrition, the strategies to combat it, and the cost effectiveness of these strategies.

However, the paper provides little guidance to policy-makers interested in knowing how to allocate public spending on nutrition across different programs. Suppose that a low-income country has $100 million to spend on improving child nutrition; how should it best allocate this budget? Should the bulk of the money be spent on micro-nutrient interventions, such as vitamin A supplementation and iron fortification, which have the highest benefit/cost ratios, and relatively little on food supplementation or community nutrition programs, which, according to the Challenge paper, are "cost-effective but more costly interventions" (p. 5)? These are tricky questions to address, but they are critical for a policy-maker facing competing challenges from a number of different nutritional interventions.

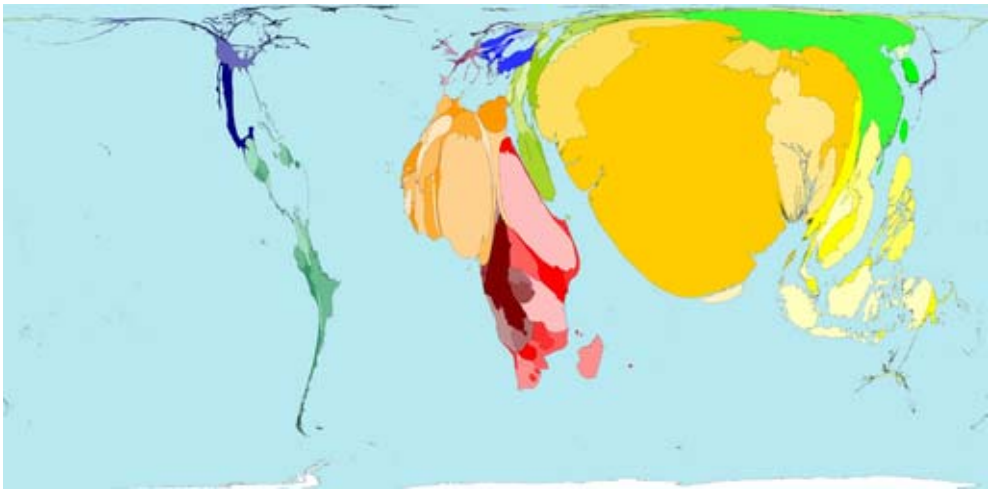
B. Micronutrient Deficiencies versus Protein-Energy Malnutrition

3. The Challenge paper reflects a broader trend that has been underway in the last decade not only in the nutrition literature but also among nutrition workers and aid organizations – viz., the tendency to view micronutrient deficiencies and protein-energy malnutrition as two separate sets of nutritional interventions. Further, there is an emerging bias in the development community in favor of programs that address micronutrient deficiencies relative to those that address PEM (Schuftan 1996, 1999). One wonders whether this is driven by the cost-effectiveness of micronutrient interventions or whether it is determined by the technical nature and ease of implementation of micronutrient deficiencies (relative to PEM). Interventions that address PEM are complicated to plan and implement, and require community and household participation in order to be successful – unlike micronutrient interventions that can often be implemented top-down (e.g., via food fortification at source) (Aranceta 2003, Suarez-Herrera 2006). Indeed, relatively little is known about which interventions reduce PEM among children and what the costs of these interventions are. In contrast, there is a good deal of evidence on interventions that address micronutrient deficiencies.

4. The over-emphasis in the literature and in the development community on micronutrient interventions and the relative neglect of PEM interventions is unfortunate for two reasons. *First*, while it is possible to deliver both micronutrients and calories in a properly-designed community nutrition program, micronutrient deficiency programs are generally focused on the delivery of a single micronutrient (e.g., iron, folate, zinc, etc.).

5. *Second*, by almost any definition, the problem of child PEM, manifested primarily in the form of low child weight and height, is extremely severe in the poorest countries in Asia and Africa. Most recent estimates for India suggest that nearly one-half of all children aged 0-3 years are underweight and about 40 per cent are stunted. In Bangladesh, the incidence is comparable, with 48 per cent of all children aged 0-3 being underweight and 43 per cent being stunted (as of 2004). This means that these two countries alone account for over one-half of the world's underweight and stunted children. If the countries of Sub-Saharan Africa are included, this number rises to three-quarters. Figure 1 illustrates the extent to which the world's child malnutrition problem is largely a South Asian and Sub-Saharan African problem.

Figure 1



Source: Worldmapper website.

6. Child malnutrition is so pervasive in South Asia that even a country such as Sri Lanka, which enjoys developed-country levels of school enrollment, adult male and female literacy, infant mortality, and life expectancy, faces a child malnutrition problem. Nearly one in three Sri Lankan children aged 3-59 months are underweight and one in seven are stunted. The incongruency between Sri Lanka's performance on infant mortality and child malnutrition is difficult to understand since most factors that produce low rates of infant and child mortality (e.g., delivery and utilization of high-quality health services, high female literacy, good hygiene and health practices, etc.) are thought to also result in lower rates of child malnutrition.

7. An even more shocking fact about child malnutrition is that its prevalence has actually increased in Sub-Saharan Africa and not declined appreciably in South Asia. India, for instance, was able to reduce its child underweight rate merely to 46 per cent in 2005-06 from a level of 52 per cent in 1992-93 in spite of being one of the fastest-growing economies in the world (growing at an average annual rate of 6 per cent over the period). The rate of stunting among children fell merely from 48 per cent to 38 per cent over the same period. If anything, India's (and, to some extent, Bangladesh's) experience

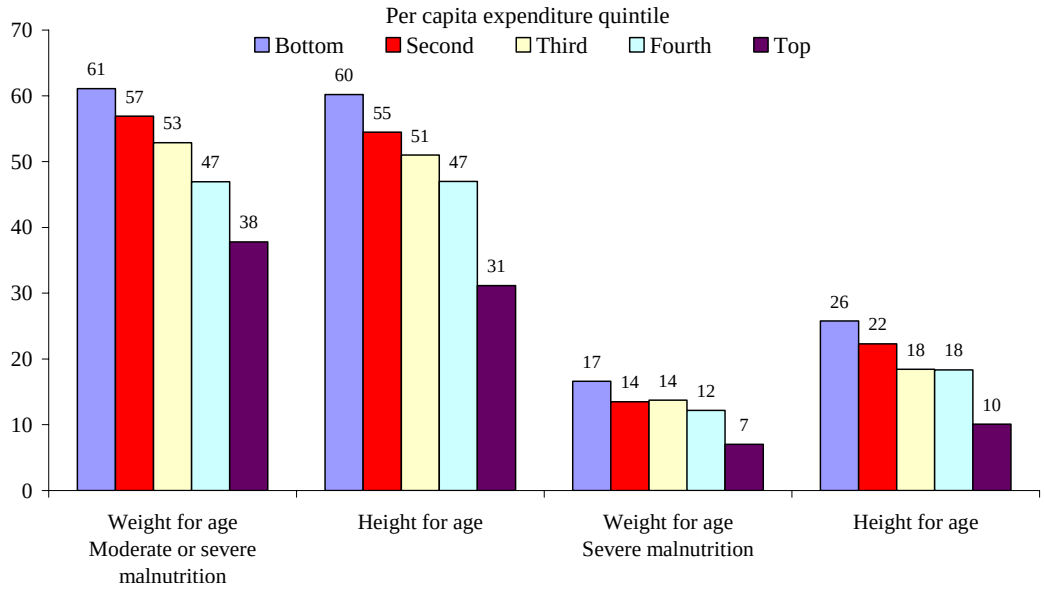
indicates that the PEM problem is unlikely to be resolved by rapid economic growth. This highlights the need for additional, pro-active interventions to address PEM. It also challenges the notion that "… poverty is a major underlying cause of malnutrition" (Challenge paper, p. 5).

8. Interestingly, there is other evidence to suggest that malnutrition is, at best, weakly related to poverty. Data from Bangladesh show that even among the richest decile of households – a group that could not possibly be food-constrained – roughly a third of the children aged 6-71 months are underweight or stunted (Figure 2). The same pattern holds for India, Pakistan, and even Sri Lanka.

9. Thus, the development community cannot afford to waver in its attention to PEM among children and its commitment to reducing PEM levels in the poorest countries of the world. The prevalence of PEM among children is unacceptably high in the poorest countries in the world; the social and economic costs of PEM are very high and well-documented; and focusing on micronutrient deficiencies alone, although extremely worthwhile, is unlikely to reduce PEM.

Figure 2

Child malnutrition rates (%) by per capita expenditure quintile, ages 6-71 months, 2000



Source: World Bank (2005).

C. The Role of Non-Nutritional Interventions in Reducing PEM

10. The Challenge paper focuses on a number of focused interventions that reduce child malnutrition, including micronutrient supplementation and fortification programs, hospital-based breastfeeding initiatives, and community nutrition programs. What is lost in this discussion is the fact that interventions outside the nutrition sector – indeed, even outside the health sector – can have profound effects on reducing child malnutrition. Indeed, it might be argued that, in the medium to long run, non-nutritional interventions, such as improving agricultural productivity, expanding female schooling, and bringing piped water and electricity to rural areas, might have larger effects on the reduction of child malnutrition than nutritional supplementation or fortification programs.

11. A study for India which estimated the determinants of child malnutrition (weight for age) based on household survey data from the National Family Health Survey and

then simulated the likelihood of the country attaining the MDGs based on assumed changes in the "intervention" variables found that a number of different interventions,

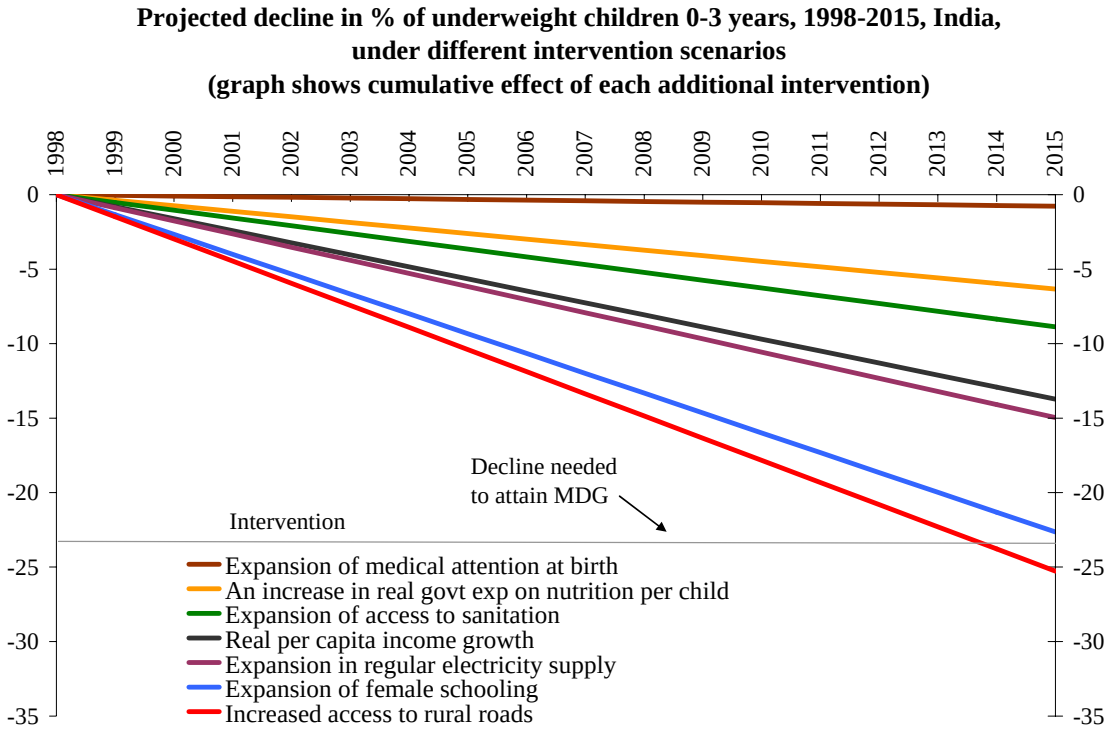


Figure 3

including economic growth, increased public spending on nutrition programs, expansion of female schooling, and improved access to regular electricity and sanitation,[1] were together likely to enable the country to attain the nutrition-related MDG (Deolalikar 2005) (Figure 3). However, an increase in public spending on nutrition alone was unlikely to help the country achieve that goal.

Source: Deolalikar (2005).

12. Another study for Bangladesh found that access to sanitation was associated with a 15 per cent reduction in the prevalence of underweight children, even after controlling for land ownership, household consumption expenditure per capita, and maternal schooling (World Bank 2005). There are numerous other studies that have reported similar results (see Christiaensen and Alderman 2004, Frost *et al* 2005). But a problem with nearly all of the studies of this genre is that the unit costs of the non-nutritional interventions (such as sanitation or electricity coverage) are not compiled, so it is not possible to know whether improved sanitation access or electricity coverage delivers more nutritional improvements per dollar of investment than community nutrition programs.

13. All of this points to a weakness in using the cost-effectiveness framework. There is a tendency in the cost-effectiveness literature to only consider those policy interventions for which unit costs have been calculated and benefit-cost ratios worked out. As a result, many worthwhile interventions, such as infrastructural investments and expansion of female education, which have been shown to convincingly reduce child malnutrition but for which cost data have not been compiled and calculated, are ignored. Indeed, it is not clear that one can use the cost-effectiveness framework to evaluate such interventions since nutritional improvements are typically only one of several objectives and outcomes of these interventions (e.g., provision of electricity influences industrial

[1] The simulation assumed that all of these variables would increase at the same rate in the future as they had during the recent past.

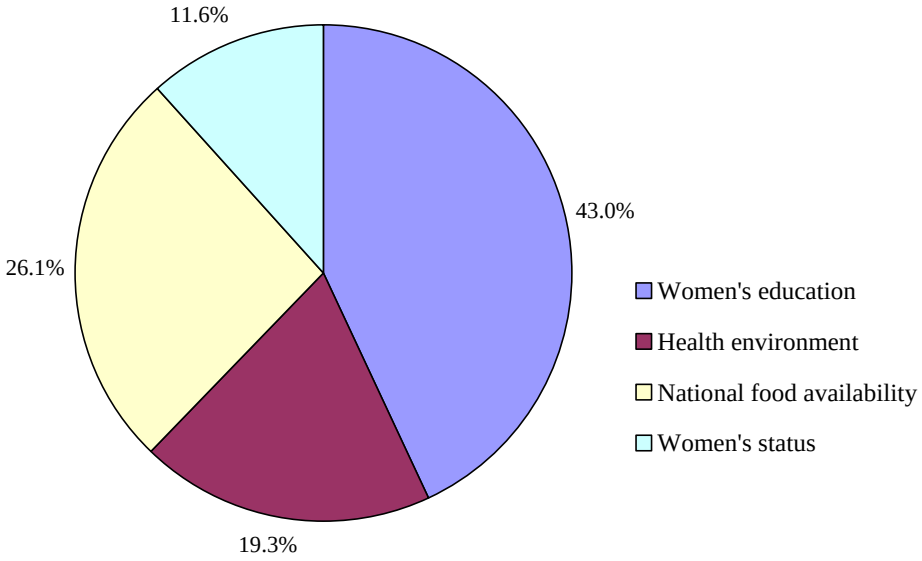
and agricultural productivity, school attendance, child health, and child nutrition, among other things).

14. Using cross-country data, Smith and Haddad (2000) attempt to measure the relative contribution of different factors to the decline in the prevalence of child malnutrition (underweight rates) in developing countries between 1970 and 1995. The study's results, summarized in Figure 4 below, are revealing; improvements in women's education contribute the most (43 per cent) to the decline in child malnutrition, followed by improvements in food availability (26 per cent) and in the health environment (as measured by access to safe water) (19 per cent). Improvements in women's status (as proxied by changes in the female-to-male life expectancy ratio) contribute 12 per cent to the total decline in child malnutrition between 1970 and 1995. Unfortunately, since consistent data across countries and over time were not available on nutritional intervention programs (indeed, many developing countries do not even have direct nutritional intervention programs), this variable was not included in the analysis. Hence, it is not possible to know the contribution of direct nutritional intervention programs relative to the contributions of female education, health improvements, and food

availability. But the study does highlight the importance of interventions outside the nutrition sector in bringing about improvements in child nutritional status.

Figure 4

Estimated contributions of factors to reductions in developing-country child malnutrition, 1970-95



Source: Smith and Haddad (2000), p. 65

15. The Challenge paper does discuss a number of interventions that can reduce PEM among children. Among these are community nutrition projects incorporating growth promotion, nutrition outreach initiatives, and nutrition components of the health-care system. The Challenge paper considers these as cost-effective but more expensive interventions relative to the micronutrient interventions. The paper correctly points out that good program design and implementation is essential for successful community nutrition interventions, and that cost-effectiveness data on these interventions is scarce. There would thus be a very high return to obtaining and calculating cost data on such interventions. There are a number of examples of successful community nutrition programs that have been effective in reducing child malnutrition in low-income settings

(e.g., the Tamil Nadu Integrated Nutrition Program in India and the programs in Indonesia and Iringa region of Tanzania).

16. In recent years, Doctors Without Borders has used a ready-to-eat paste preparation successfully in alleviating starvation among children in countries such as Niger that have been hit hard by famine. The paste consists of powdered milk, ground peanuts, oil, sugar, vitamins, and minerals, and does not need water for preparation, which reduces the likelihood of food for infants and children being contaminated with unclean water. Such ready-to-eat supplements have proven to be highly effective in producing rapid weight gain and reversing severe PEM among starving children. But there is no reason to wait until children are at a point of starvation to provide such supplements; the latter could be included in routine community nutrition programs or even be distributed through the same channels as micronutrient supplements are (Shepherd 2008, Flax *et al.* 2008). Unfortunately, cost data on the high-density paste supplement are not readily available, so it is not possible to calculate the cost-effectiveness of this intervention. However, it is unlikely that the cost effectiveness of this supplement differs significantly from that of micronutrient interventions.

D. Role of Agricultural Productivity and Food Security in Reducing PEM

17. While it is obvious that child malnutrition has multiple causes, insufficient food availability at the individual or household level can nevertheless be an important contributing factor to undernutrition. It is widely recognized that food security at an aggregate level (e.g., at the level of a district, state or country) does not always translate into food security at the household level. India offers a telling example of this assertion; on average, the country produces more than enough food to feed its population, yet there are large numbers of people who are unable to meet their nutritional requirements. In Sub-Saharan Africa, the correlation between child malnutrition and food security is even stronger. This highlights the importance of agricultural productivity in reducing child

malnutrition; low levels of agricultural productivity result in higher food prices, which in turn lead to malnutrition, especially among the most vulnerable children.

18. Large advances in biotechnology have taken place in recent years. There is tremendous scope for these technological advances to improve food security as well as promote environmental conservation (Tilman *et al*. 2001). Yet it is ironic that many countries with high child malnutrition rates have banned genetically-modified foods owing to concerns about food safety and biodiversity.

19. Since last year, many countries around the world have been facing food shortages and rising food prices. For instance, international wheat prices have risen 123 percent in the last year alone. Rice and maize prices have increased by 40-50 percent over the last year in several developing countries. Unfortunately, due to a number of factors, including long-term climate change and the rising global demand for bio-fuels – caused by consumers in developed nations switching from fossil fuels to ethanol – these food shortages and price increases are going to become endemic. This will have serious repercussions for child malnutrition, especially in the poor countries of South Asia and Sub-Saharan Africa. This makes the case for biotechnology – to increase crop yields and thereby improve food security – even more compelling. Once again, it is not clear that the cost-effectiveness approach can be applied to interventions that increase agricultural productivity, since the latter typically have multiple goals (only one of which is the reduction in hunger and malnutrition).

E. Concluding Remarks

20. To summarize, while the BCR estimates provided by HAR in the Challenge paper are helpful in thinking about how to prioritize nutritional interventions, there are certain inherent limitations to these estimates. First, by ignoring the synergies among the various interventions (e.g., micronutrient supplementation and food supplementation), these

estimates underestimate the potential benefits that could be realized from integrating different nutritional interventions. For instance, there is some evidence that iron supplementation increases the capacity for physical growth among iron-deficient anemic children (Peragallo-Guarda 1984, Chwang *et al*. 1988, Lawless *et al*. 1994), so integrating iron supplementation into a community nutrition program could increase the benefits, and thereby the BCR, of both iron supplementation and community nutrition programs. This points to a general problem with most BCR estimates – viz., they assume a certain ('typical' or 'ideal') mechanism for delivering a nutritional or micronutrient supplementation intervention. Changing the delivery mechanism (e.g., undertaking an intervention in isolation or integrating it with another intervention) can dramatically change the BCR of an intervention.

21. Second, a related point is that HAR, and all other cost-effectiveness studies, assume the BCRs to be static. In fact, cost-effectiveness of interventions is likely to be dynamic; the more experience a country has with a particular intervention, the lower will be the costs of that intervention (via learning-by-doing) and the higher will be the resulting BCR. This means that if certain interventions are not chosen because they do not have the highest BCR at a given point in time, a country may give up the opportunity to try these interventions out and reduce their costs (and increase their BCR) in the long run via learning-by-doing. Community nutrition programs have low BCRs precisely because they rely on behavioral change and community organization and are significantly more difficult to implement than vertical micronutrient supplementation programs. However, over time, the BCR of these programs would be expected to rise as communities become better at delivering nutritional programs.

22. Third, as Bhutta et al. (2008) argue, only about a third of stunting can be averted with available interventions in the short term, since maternal and antenatal factors have a powerful influence on stunting via low birth-weight. For instance, the use of insecticide-treated bed-nets for pregnant women and prenatal care can have an important influence on birth-weights and thereby on child nutrition and stunting. While HAR acknowledge

the importance of these prenatal-based interventions, they do not consider them either because "insufficient new material was not available to warrant discussion" or that improved child nutrition is only one of many benefits of prenatal care or malaria prevention.

23. Fourth, a non-trivial portion of the world's malnutrition problem manifests itself in the form of what one might call 'emergency malnutrition' – viz., widespread protein-energy malnutrition brought about civil conflict and natural disasters. Drought in the Sahel in the early 1980s affected tens of millions of children and adults in Mauritania, Mali, Chad, Niger and Burkina Faso. More recently, the civil conflict in Darfur has brought about a humanitarian malnutrition crisis in Sudan. The estimates in HAR provide little guidance on how to deal with such humanitarian nutritional crises. It would be useful to know the most cost-effective strategies for relieving acute malnutrition in emergency situations.

24. Finally, it is important to recognize that non-nutritional interventions, such as improved water, sanitation, transport and power infrastructure, as well as policies that enhance agricultural productivity and dietary diversification, might have larger effects on reducing malnutrition than nutritional interventions. The cost-effectiveness of these interventions is extremely difficult, if not impossible, to calculate, as nutritional improvements are only one of several objectives and outcomes of these interventions (e.g., provision of electricity influences industrial and agricultural productivity, school attendance, child health, and child nutrition, among other things). But that should not detract from considering them as extremely worthwhile approaches to fighting malnutrition.

REFERENCES

Aranceta J. 2003. "Community nutrition." *European Journal of Clinical Nutrition* 57, Suppl. 1: S79–S81.

Arimond, Mary and Marie T. Ruel. 2004. "Dietary Diversity Is Associated with Child Nutritional Status: Evidence from 11 Demographic and Health Surveys." *Journal of Nutrition* 134 (October): 2579-2585.

Baer, Edward C. 1981. "Promoting Breastfeeding: A National Responsibility." *Studies in Family Planning* 12(4): 198-206.

Chwang, L., A. G. Soemantri, and E. Pollitt. 1988. "Iron Supplementation and Physical Growth of Rural Indonesian Children." *American Journal of Clinical Nutrition* 47: 496-501.

Deolalikar, Anil B. 2005. *Attaining the Millennium Development Goals in India: Reducing Infant Mortality, Child Malnutrition, Gender Disparities and Hunger-Poverty and Increasing School Enrollment and Completion?* Oxford University Press, New Delhi.

Flax, Valerie L., Ulla Ashorn, John Phuka, Kenneth Maleta, Mark J. Manary, and Per Ashorn. 2008. "Feeding Patterns of Underweight Children in Rural Malawi Given Supplementary Fortified Spread at Home." *Maternal and Child Nutrition* 4(1), January: 65-73.

Lawless, J. W., M. C. Latham, L. S. Stephenson, S. N. Kinoti, and A. M. Pertet. 1994. "Iron Supplementation Improves Appetite and Growth in Anemic Kenyan Primary School Children." *Journal of Nutrition* 124: 645-654.

Peragallo-Guarda, N. 1984. "Severity of Iron Deficiency Anemia and Its Relationship to Growth and Morbidity in a Population of Pre-Schoolers in Rural Guatemala." Doctoral dissertation presented to the faculty of University of Texas Health Science Center, Houston, TX.

Rouse, Dwight J. 2003. "Potential Cost-Effectiveness of Nutrition Interventions to Prevent Adverse Pregnancy Outcomes in the Developing World." *Journal of Nutrition* 133 (May):1640S-1644S.

Schroeder, Dirk G., Reynaldo Martorell, Juan A. Rivera, Marie T. Ruel and Jean-Pierre Habicht. 1995. "Age Differences in the Impact of Nutritional Supplementation on Growth." *Journal of Nutrition* 125 (April): 1051-1059.

Schuftan, Claudio. 1996. "The Community Development Dilemma: When are Service Delivery, Capacity Building, Advocacy and Social Mobilization Really Empowering? *Community Development Journal* 31(3): 260-264.

Schuftan, Claudio. 1999. "Different Challenges in Combating Micronutrient Deficiencies and Combating Protein Energy Malnutrition, or the Gap Between Nutrition Engineers and Nutrition Activists." *Ecology of Food and Nutrition 37(6)*, December.

Schuftan, Claudio. 2003. "Poverty and Inequity in the Era of Globalization: Our Need to Change and to Re-Conceptualize." *International Journal of Equity Health* 2: 4-10.

Shekar, Meera and M.C. Latham. 1992. "Growth monitoring Can and Does Work: An Example from the Tamil Nadu Integrated Nutrition Project in Rural South India." *Indian Journal of Pediatrics* 59(1).

Shepherd, Susan. 2008. "Instant Nutrition." Op-Ed Contribution, *New York Times*, January 30.

Smith, Lisa C and Lawrence Haddad (2000). "Explaining Child Malnutrition in Developing Countries: A Cross-Country Analysis." Research Report 111, International Food Policy Research Institute, Washington DC.

Suarez-Herrera, Jose Carlos. 2006. "Community nutrition Programmes, Globalization and Sustainable Development." *British Journal of Nutrition* 96, Supplement 1, S23-S27.

Tilman, David, Peter Reich, Johannes Knops, David Wedin, Troy Mielke, and Clarence Lehman. 2001. "Diversity and Productivity in a Long-Term Grassland Experiment." *Science* 294: 843-845.

World Bank. 2005. *Attaining the Millennium Development Goals in Bangladesh: How Likely and What Will It Take?* Human Development Unit, South Asia Region, World Bank, Washington DC.