



The neglected crisis of undernutrition: Evidence for action

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Definitions and measurements

Malnutrition: An abnormal physiological condition caused by deficiencies, excesses or imbalances in energy, protein and/or other nutrients.

Undernutrition: is when the body contains lower than normal amounts of one or more nutrients i.e. deficiencies in macronutrients and/or micronutrients. *'Undernutrition encompasses stunting, wasting and deficiencies of essential vitamins and minerals (collectively referred to as micronutrients).'*¹

Child undernutrition is most commonly measured by anthropometric indices:

Indices	Measure and cut off values	An indicator to determine:
Low birth weight	Birth weight < 2.5 kg	Intra-uterine growth restriction and/or pre-maturity
Stunting	Height for age < - 2 SD	Chronic malnutrition (usually the result of a poor diet and disease over a prolonged period)
Wasting	Weight for height < -2 SD	Acute malnutrition (usually the result of a severe lack of food and/or disease)
Underweight	Weight for age < -2 SD	A composite measure of stunting and/or wasting
Low arm circumference	Mid-Upper Arm Circumference < 13.5 cm	Acute malnutrition

A child can be stunted without being wasted (or vice versa). Data from 19 Demographic and Health Surveys showed that severe wasting was not accompanied by stunting in 80 – 100% of younger children and 40 – 50% of older children.²

¹ Black RE, Allen LH, Bhutta ZA, Caulfield LE, de Onis M, Ezzati M, Mathers C, Rivera, J, for the Maternal and Child Undernutrition Study Group 2008, Maternal and child undernutrition: global and regional exposures and health consequences, Article 1, Lancet 371, 243-60

² ibid.

Undernutrition is also indicated by clinical signs (e.g. bilateral oedema, goitre for iodine deficiency) or biochemical indices (e.g. haemoglobin level for iron deficiency anaemia).

Severe Acute Malnutrition (SAM): A weight-for-height measurement of 70% or less below the median or 3 SD or more below the mean international reference values, the presence of bilateral pitting oedema, or a mid-upper arm circumference of less than 115 mm in children 6 – 60 months old.³

In 2006, WHO, with the agreement of other international bodies on nutrition, revised its **international standards** by which countries should measure children's nutrition status. Many countries have already started using the new growth standards or are in the process of doing so. Some of them also plan to incorporate height measurement to assess stunting at the individual level.

MDG 1 – Eradicate extreme poverty and hunger – has two associated indicators for its hunger target:

1) Prevalence of underweight among children under five years of age measures malnutrition at an individual level, collated by WHO and maintained in a global database on nutrition that allows comparability across countries.

2) Proportion of the population below a minimum level of dietary energy consumption measures hunger and food security, and is measured only at a national level (not at an individual level) through national food balance sheets based on aggregate data on food availability and assumed patterns of food distribution in each country. However, increased aggregate food availability is not synonymous with improving nutrition.

Food security: When all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life. **Nutrition security** is achieved when secure access to appropriately nutritious food is coupled with a sanitary environment, adequate health services and care, to ensure a healthy and active life for all household members.

Hunger is often used to refer in general terms to MDG1 and food insecurity. Acute hunger is when lack of food is short term, and is often caused when shocks such as drought or war affect vulnerable populations. Chronic hunger is a constant or recurrent lack of food and results in underweight and stunted children, and high infant mortality. 'Hidden hunger' is a lack of essential micronutrients in diets.

³ WHO and UNICEF, 2009, WHO child growth standards and the identification of severe acute malnutrition in infants and children. A Joint Statement by the World Health Organization and the United Nations Children's Fund.

Executive summary

1. This *paper focuses on undernutrition*⁴: the most pervasive form of malnutrition to date in the poorest countries, where DFID concentrates the bulk of its assistance. This Evidence Paper informs the development of a separate DFID Strategy Paper for tackling undernutrition in the developing world.

2. This paper does not set out to provide a comprehensive review of all the relevant and most up to date evidence on undernutrition, nor is it based purely on peer reviewed journals. It cannot do justice to the richness of the debate on some of the facts and figures referred to. It reflects the type of evidence that informs DFID's and others' policy formulation and the major findings. It is important to acknowledge that the quality and sources of evidence vary. There is a reasonable body of evidence on many of the determinants and impacts of undernutrition, and the cost-effectiveness of direct interventions. There is less on how such interventions can be effectively scaled up in different settings. There is more on the 'direct' interventions than on the impact, relative importance and cost effectiveness of indirect interventions that tackle the drivers of undernutrition. DFID's research agenda will contribute towards filling some of the gaps in the evidence.

3. *Nutrition fundamentally determines life chances and people's ability to convert opportunities into outcomes. The consequences are long-term, inter-generational and irreversible*, with the effects of poor foetal growth and/or stunting in the first two years of life being sustained into adulthood⁵. Nutrition is, essentially, a foundation for the attainment of the MDGs. Improved nutrition will significantly reduce child and maternal mortality, improve educational outcomes, and increase productivity and growth. Prevention of malnutrition is therefore a long-term investment, which greatly benefits both present and successive generations and preserves human capital.

Scale

4. Though many countries are on-track in improving income poverty (MDG 1a), *less than a quarter of developing countries are on-track for achieving the goal of halving undernutrition* (MDG 1c). The global burden of undernutrition is high and getting worse in places. In countries with high growth, such as India, undernutrition persists or has worsened. The (estimated) number of undernourished people in developing countries was 824 million in 1990-92. In 2003-05, the figure stood at 848 million;

⁴ Undernutrition is measured by stunting (low height for age that indicates chronic undernutrition), wasting (low weight for height, indicating acute undernutrition) and underweight (low weight for age, a composite of the other two measures).

⁵ Evidence includes: Victora CG, et al, for the Maternal and Child Undernutrition Study Group 2008, Maternal and child undernutrition: consequences for adult health and human capital, Article 2, Lancet 371, 340-57; Harper, C., Marcus, R., Moore, K. (2003) Enduring Poverty and the Conditions of Childhood: Lifecourse and Intergenerational Poverty Transmissions. World Development Vol. 31. No 3. pp 535-554.

it went up to 923 million in 2007 and reached 967 million in 2008.⁶ The prevalence of underweight amongst children less than five years has only declined from 32% to 27% between 1990 and 2006.⁷

5. Undernutrition is a concentrated epidemic, but of low national priority. The recent Lancet series⁸ updated the figures. *80% of the world's undernourished children (using the stunted measure, with low height for age) live in just 20 countries in the world.* The global prevalence of stunting in under fives in 2005 was 32%. Some 10% of all children globally (55 million) are wasted. 19 million children worldwide suffer from severe acute malnutrition. Of the 112.4 million underweight young children globally (with a low weight for age), the highest prevalences are found in south-central Asia (33%) and eastern Africa (28%).⁹

6. The little progress that has been made to date is threatened by a series of global trends, such as *rising food and oil prices, climate change, and increased state fragility, conflict and emergencies.* The World Bank estimates that as many as 130–155 million more people in the world have been forced into extreme poverty and that for “very poor people, reducing consumption from already low levels even for a short period has severe long-term consequences. Higher food prices during 2008 alone may have increased the number of children suffering permanent cognitive and physical injury due to malnutrition by 44 million.”¹⁰

Determinants

7. *Undernutrition arises from complex, multiple, interactive causes, both direct and indirect.* The two immediate causes are inadequate dietary intake and disease. Health and sanitation, food security, and care, particularly the feeding practices of young children, contribute to nutritional status. Ultimately, these factors are embedded in the larger political, economic, social and cultural environment. Food insecurity, ill health and sub-optimal caring practices are all closely related to poverty. Undernutrition reflects and contributes to inequality, disproportionately affecting poor, excluded and extremely vulnerable groups. The drivers of acute and chronic undernutrition are related but can be different: acute undernutrition, for example, is usually the result of a severe lack of food and/or disease.

8. *Nutrition-security and food self-sufficiency are not the same.* Many countries have achieved “food self-sufficiency”, which simply means they are not net food importers, but have not achieved nutrition security. While food insecurity is

⁶ FAO, 2008, The State of Food Insecurity in the World – High Food Prices and Food Security Threats and Opportunities.

⁷ UNICEF, 2007, Progress for children: A world fit for children – Statistical review, n°6.

⁸ Black RE, Allen LH, Bhutta ZA, Caulfield LE, de Onis M, Ezzati M, Mathers C, Rivera, J, for the Maternal and Child Undernutrition Study Group 2008, Maternal and child undernutrition: global and regional exposures and health consequences, Article 1, Lancet 371, 243-60.

⁹ *ibid.*

¹⁰ World Bank, 2009 a, Global Economic Prospect – Commodities at the Crossroads.

acknowledged as a cause of undernutrition, the exact relationship between the two is not well understood. Even if a person consumes enough calories, this does not guarantee adequate intake of essential micronutrients – vitamins, minerals and trace elements.

9. *The relationship between nutrition and infectious disease is a synergistic one:* infections result in decreased dietary intake and the malabsorption of nutrients, leading to undernutrition, which itself reduces children's resistance to infection, thus increasing the likelihood of repeat infections. The effect of infections on the nutritional status of young children is well documented¹¹ and appears to be directly proportional to the severity of infection.¹²

10. Although the actual amount of food ingested by a child is closely related to food security, it is critically dependent on the *care-related feeding behaviours of the child's caretaker*, such as breastfeeding, complementary feeding and food preparation.

11. *The prevalence of stunting increases with poverty. For instance, a review of data from 50 developing countries showed that severe stunting was almost three times higher amongst the poorest wealth quintile (18.0%) compared to the richest wealth quintile (6.2%)*¹³. Furthermore, while the main causes of malnutrition appear to change as a child grows, the links between child undernutrition and household wealth remains strong. Income poverty limits the options parents have for properly caring for their children. A study conducted in 4 locations in Myanmar, Ethiopia, Bangladesh and Tanzania showed that the minimum cost of a healthy diet is beyond the means of most poor households.¹⁴

12. Women play a leading role in all three areas of food, health and care and in use of nutrition information in the household. They are also responsible for a substantial portion of global food production. *The socially constructed gender roles of men and women interact with their biological roles to affect the nutrition status of the entire family and of each gender.* Low women's status results in a clear negative effect on children's nutritional status everywhere, though the strength of the relationship between maternal status and infant nutrition varies across regions.

13. The effects of discrimination on the basis of social identity, beyond gender, on nutritional outcomes is little studied. Recent evidence from India does, however, illustrate the problems and knock-on effects associated with *social exclusion* in terms of access to nutritional services¹⁵.

¹¹ World Bank, 2008, Environmental Health and Child Survival: Epidemiology, Economics and Experience.

¹² Powanda and Beisel, 2003, Metabolic effects of infection on protein and energy, Journal of Nutrition 133 in *ibid*.

¹³ Gwatkin, RD, 2007, Socio-economic differences in health, nutrition and population within developing countries: An overview, World Bank.

¹⁴ Chastre, C., Duffield, A., Kindness, H., LeJeune, S., Taylor, A., 2007, The minimum cost of a healthy diet – Findings from piloting a new methodology in four study locations. Save the Children.

¹⁵ A Government of India/DFID India study found that it was not only geographical distance or knowledge of services that limited access; but institutional discrimination and self exclusion equally contribute to undernutrition.

Impacts

14. *The long-term consequences of chronic malnutrition are far-reaching.* As recognised in the Lancet (2008) series: “data supports a strong association between maternal and child undernutrition and adult short stature, reduced school attendance, and diminished economic potential.”

15. *Undernutrition is an underlying factor in more than 35% of preventable deaths among children under 5 years.*¹⁶ In 2004, the disease burden for children under 5 equated to an estimated 150 million years of healthy life lost. This was more than five times that for malaria (some 29 million years of healthy life lost).¹⁷ Undernutrition weakens the immune system and generally makes a person more susceptible to infections, including diarrhoea.

16. In many places, including India, nutritional deprivation has two major consequences for women: they never reach their full growth potential and they suffer from anaemia¹⁸. Both are risk factors in pregnancy. High levels of anaemia complicate childbearing and result in maternal and infant deaths and low birth-weight infants. *20% of maternal deaths are associated with iron-deficient anaemia and maternal short stature.* 1 in 6 children are born with low birth weight¹⁹.

17. Maternal and child undernutrition contributes to 3.5 million deaths every year, and accounts for 11% of total global Disability Adjusted Life Years (DALYs) that equate to lost years of healthy life.²⁰

18. *Poor foetal growth, stunting and resultant cognitive-social impairment is irreversible after the age of two years.*²¹ In general, undernutrition impairs brain development and cognitive abilities during the early days and can contribute to delayed enrolment and lower learning outcomes at a later stage. A recent multi-country study showed that for every 10% increase in stunting, the proportion of children reaching the final grade of school dropped by almost 8%.²²

¹⁶ Black et al, 2008, op cit.

¹⁷ Estimates based on WHO Global Burden of Disease 2004 updated using the following assumptions: 35% of under 5 DALYs and Deaths attributable to nutrition (Source: Lancet). *It must be remembered that undernutrition is a risk factor for malaria.*

¹⁸ <http://www.azadindia.org/social-issues/GenderInequality.html>.

¹⁹ UNICEF, 2004, Low birth weight: country, regional and global estimates. “More than 20 million infants worldwide, representing 15.5 per cent of all births, are born with low birthweight, 95.6 per cent of them in developing countries. The level of low birthweight in developing countries (16.5 per cent) is more than double the level in developed regions (7 per cent).”

²⁰ In Disability Adjusted Life Years (DALYs) per 100,000 population. The DALY is a measure of the burden of ill health taking into account reduced life expectancy and quality of life. The number of DALYs lost as a result of a disease is calculated by estimating the number of years lost due to premature death plus equivalent years of ill health.

²¹ Victora CG, et al, for the Maternal and Child Undernutrition Study Group 2008, Maternal and child undernutrition: consequences for adult health and human capital, Article 2, Lancet 371, 340-57.

²² Grantham-McGregor, S. et al (2007), ‘Child Development in Developing Countries: Developing Potential in the First 5 Years for Children in Developing Countries’, The Lancet, Vol. 369, No. 9555: 60-70 cited in Chastre et al 2007 The Minimum Cost of a Healthy Diet Findings from piloting a new methodology in four study locations, Save the Children.

19. The positive economic impacts of improved nutrition are numerous. There are at least three ways in which the gains from improved nutrition manifest themselves²³: (i) *direct gains in productivity* arising from improvements in physical stature and strength, as well as improvements in micronutrient status. Productivity losses are estimated at 10% of lifetime earnings and GDP lost to undernutrition runs as high as 2–3% (ii) *indirect gains arising from links between nutritional status, schooling and cognitive development*, as well as subsequent adult labour productivities, and (iii) savings of resources currently directed to health care, disease treatment and other problems associated with malnutrition. Studies have estimated that preventing micronutrient deficiencies in China and India would save these two countries US\$5 and \$2.5 billion per year, respectively²⁴. Just under 100 million US dollars in agricultural productivity over 5 years was estimated to be likely to be lost through the lack of effective policies to tackle women's anaemia in Sierra Leone²⁵.

20. The Nobel prize in Economy winner, R.W. Fogel estimated that “the combined effect of the increase in dietary energy available for work, and of the increased human efficiency in transforming dietary energy into work output, appears to account for about 50 percent of the British economic growth since 1790.”²⁶

Interventions

21. Over the last ten years, knowledge about what works in terms of nutrition interventions has been strengthened. Insights from nutrition include recognition that *improving the nutrition status of women before and during pregnancy and improving the nutrition status of infants in the first two years of life is critical*. Both boost the lifetime well-being of the individual and weaken the intergenerational cycle of poverty.

22. Nutrition interventions and policies are often classified as “direct” and “indirect” according to the level of causes addressed. They can also be classified as short and long routes out of undernutrition according to the likely time-span before a reduction of undernutrition is felt. There is broad agreement that the recent Lancet Nutrition Series 2008 brings an important new body of evidence for the benefit of a set of specific, direct nutrition interventions.

23. *Breastfeeding promotion, appropriate complementary feeding, supplementation with vitamin A and zinc, and appropriate management of severe acute malnutrition* (e.g. therapeutic feeding) show the most promise for reducing

²³ Alderman, H., J. R. Behrman, J. Hoddinott as part of Health, Human Capital and Economic Growth, 2003, Nutrition, Malnutrition and Economic Growth, WHO; World Bank, 2006

²⁴ Shekar, M and Lee, Y-K, 2006, Mainstreaming nutrition in poverty reduction strategy papers: what does it take, A review of the early evidence. HNP discussion paper, Health Nutrition and Population, World Bank

²⁵ Aguaya, VM et al on behalf of the PROFILES study group in Sierra Leone, 2003, Sierra Leone – investing in nutrition to reduce poverty: a call for action Public Health Nutrition: 6(7), 653–657

²⁶ Fogel R.W., 1993, Economic Growth, Population theory, and physiology: the bearing of long-term processes on the making of economic policy – Nobel Lecture, December 9, 1993

child deaths and future disease burden related to undernutrition. According to the Lancet, universal coverage with the full package of proven interventions at observed levels of programme effectiveness could prevent about one-quarter of child deaths under 36 months of age, reduce the prevalence of stunting at 36 months by about one-third and avert 60 million lost years of healthy life (DALYs) in the 36 worst affected countries.²⁷

24. *The cost effectiveness of these interventions are very high.* The provision of supplements of vitamin A and zinc to children in developing countries, to prevent avoidable deficiencies that affect hundreds of millions of children, is the most cost-effective development intervention, the Copenhagen Consensus initiative found. It costs some 3-70 USD per years of healthy life lost for a range of proven direct nutritional interventions. This compares with 11 USD/DALY for bed nets and 301 USD/DALY for a short course of tuberculosis therapy.²⁸

25. The evidence base and the science for improving nutrition outcomes through direct interventions are relatively well established; yet very few countries are implementing these interventions with proven effectiveness at scale. Achieving progress is not just about finding new technological solutions, but also about taking to scale the known solutions through creative delivery mechanisms.

26. Direct interventions only address the immediate causes of malnutrition and, as noted, will only reduce child deaths by one quarter and stunting by one third in children under 36 months.²⁹ It is imperative to simultaneously focus on indirect actions. It is *only through concerted efforts* to tackle the drivers of undernutrition *that lasting solutions to nutritional problems will be found*. Interventions that address a single contributing factor such as food availability without considering the broader context are less likely to show sustainable gains.

27. Addressing undernutrition requires inputs from multiple sectors: health, agriculture, women's empowerment, water/sanitation, community-driven development, and increasingly, the private sector. However, there is much *less evidence around how indirect interventions map onto nutrition outcomes*. Such interventions are not necessarily designed with a nutrition objective in mind and hence are not evaluated by this criterion. It is also difficult to ascertain their impact on undernutrition when they are used as preventative measures and/or when a complex causal pathway is involved.

28. *The linkages between agriculture and nutrition are highly bi-directional*, although there is a need to better understand the links between agricultural

²⁷ Bhutta ZA, Ahmed T, Black RE, Cousens S, Dewey K, Guigliani E, Haider BA, Kirkwood B, Morris SS, Sachdev HPS, Shekar M, for the Maternal and Child Undernutrition Study Group 2008, What works? Interventions for maternal and child undernutrition and survival, the Lancet series on Maternal and Child Undernutrition, Article 3, 371, 417-40.

²⁸ Jamison TJ et al. 2006. Disease Control Priorities in Developing Countries.

²⁹ Bhutta et al, 2008, op cit.

production, food security and nutrition. Larger yields may increase food supply, but mono-crop production or greater quantities of low-nutrient content crops do not necessarily translate into adequate quality with respect to nutrition.

29. Increasing dietary quality and quantity can be achieved, in part, by investments in agricultural research that improves the micronutrient value of crops. Increased production of horticulture products and livestock has in the past been agriculture's main avenue to improve diet quality. Other pathways now include bio-fortification of staple crops and higher levels of vitamins and minerals through crop breeding and biotechnology. With a nutrition lens, agricultural practices and policies can be examined to determine if agriculture can have a larger role in reducing micronutrient deficiencies and undernutrition through increased production of micronutrient-rich foods such as fruits, vegetables and livestock. Strategies to increase agricultural productivity and sustainability must also focus on increasing women's access to and control over productive assets such as land tenure and water.

30. Social transfers to protect the chronically food insecure and promote improved livelihoods can be complementary to investments in agricultural productivity and growth. Through their regularity and predictability, social transfers can insure the poor against shocks and stresses, and reduce the need for people to sell assets. *Most studies that have quantified the impact of social transfers on nutrition, hunger or food security have identified a positive impact*, although a wide range of methodologies were used, making it difficult to generalise about the size of impact.

31. To date, there are no agreed tools available to determine how big social transfers should be and what type of social protection measures or package would be optimally required in order to achieve specific nutritional objectives. More research and evaluation work is required in order to maximise the potential of social protection programmes delivering nutrition impacts, including assessments of the viability of coupling transfers with other actions such as the delivery of micronutrients and nutrition education.

32. Examples of successful interventions, in terms of both *nutritional outcomes and gender equality*, have included enabling women to gain access to new resources, implementing cash transfer programs that promote girls' education and health care, introducing technologies that save household labour, subsidizing child care for working parents, and initiating programs to improve the nutritional status of adolescent girls and young women.

33. It is estimated *that improvements in women's education* were responsible for 43% of the reduction in child malnutrition that occurred between 1970 and 1995; improving the availability of food has accounted for only 25%³⁰. Data from

³⁰ Smith, L., Haddad, L., 2000, Explaining child malnutrition in developing countries: A cross country analysis, Research report 111. International Food Policy Research Institute.

25 developing countries suggest that 1-3 years of maternal schooling reduces child mortality by 15%.³¹

34. The potential of improved access to safe *water and sanitation* on nutrition through time, money and energy savings (particularly among women and girl-children) is little researched. However, given that sector experts assess that some 50% of the consequences of undernutrition may be caused by environmental factors, including a lack of access to safe water and sanitation and/or poor hygiene practices³², it is likely that simply through the aversion of enteric infections, environmental health interventions may significantly impact nutrition. Appropriate nutritional indicators should be included in water and sanitation programme monitoring.

35. *Large-scale effectiveness evaluations that can expand the evidence base for strategies and tactics to achieve high, sustained and equitable coverage to address undernutrition are lacking.* There is a shortage of rigorous and policy relevant impact evaluation studies providing evidence on the scope, cost, scalability and impact of varied direct and especially indirect interventions. It is, however, equally necessary to look at the social, economic, and political institutions that mediate access to and control over resources, choices and benefits to ensure sustained and equitable improvements.

36. A number of initiatives are currently underway to develop *costing models and tools for implementing essential nutrition interventions at scale* in high burden countries. The UN estimates an annual resource gap of \$1323 to \$1762 million for preventative actions and \$173 to \$338 million for curative in Sub Saharan Africa.³³ The World Bank is currently conducting an exercise to generate more precise figures.

Response

37. The international community spends too little, and lacks co-ordination and coherence. *The “funding, technical, executing and opinion-shaping institutions that make up the global nutrition sector have not coalesced into the same policy, funding and implementation community that exists for some other major global health priorities, such as immunization”*³⁴.

38. It is clear that despite the seriousness of the problems associated with maternal and child undernutrition, the amount of *nutrition-related aid* provided to the 20 countries with 80% of globally stunted children is a small sliver of the total aid

³¹ Ramachandran, N, 2006, Women and food security in South Asia, UNU-WIDER.

³² World Bank Environmental Burden of Disease Series, No. 12; Prüss-Üstün A and, Corvalán C., 2006, Preventing disease through healthy environments. Towards an estimate of the environmental burden of disease, WHO.

³³ Darnton-Hill, I., Krasevec, J., Cogill, B., and Schultink, W., 2008, Global strategy and resource estimates for effective policy, UNICEF.

³⁴ Levine, R and Kuczynski, D, 2009, Global Nutrition Institutions: Is There an Appetite for Change?, Centre for Global Development.

provided to these nations. As oil and food prices followed by the global economic crisis put increased pressure on the fiscal position of many developing countries, in already resource-constrained scenarios, there will be increasing pressure to redress this imbalance given the magnitude and long term nature of the effects.

39. *Nutrition can only be described as “everybody’s business and nobody’s responsibility”; a political, administrative and “institutional orphan.”*³⁵ Nutrition is a non-exclusive investment opportunity: many sectors can invest in improving it. However, nutrition is often located within one line ministry. In the absence of strong incentives to develop cross-ministerial policies and programs for food and nutrition security, sector-specific homes for nutrition will end up favouring one pillar of good nutrition at the expense of the others. The many sectors and bodies involved in tackling undernutrition require complex institutional arrangements and strong coordination mechanisms.

40. *Lack of political commitment, capacity and data are severe constraints to action.* A high prevalence of undernutrition in a population is generally not seen as anomalous and indicative of a government’s inability to fulfil its duties to its citizens. There is low political demand for action against undernutrition. Capacity constraints are particularly severe and the rationale for an enhanced focus on capacity is particularly relevant to nutrition, because malnutrition is multi-causal and its solutions multi-sectoral. Poor quality data, analysis and interpretation are often reported. The information base could be greatly enhanced by a stronger analysis of the causes of malnutrition and their relative importance. Well functioning information systems are key to ensure a timely and appropriate response.

41. *Rapid improvements in nutritional status and prioritisation, however, can happen.* Underweight in children in *Brazil*, for example, has been reduced from 10% in 1999 to 2.4% in 2006, through a combination of coordinated government programmes and mechanisms including a cash transfer, maternal and child health strategies and micronutrient distribution.³⁶ Such positive experiences have demonstrated that leadership and strategic capacity are key ingredients for advancing the national nutrition agenda. Furthermore, programme experience and research show that when interventions address the multiple causes of malnutrition, harmonise the way institutions provide services and work with communities, and attend to the resource needs of both men and women, nutritional well-being improves in a timely and sustainable manner. Broad and inclusive partnerships are required, including strong public-private partnerships and the active participation of communities, enabling the voices of traditionally excluded people to be heard.

³⁵ Attributed to Carsten Nilaus Pedersen, Under Secretary for Bilateral Cooperation at the Food, Nutrition and Gender Seminar, April 2009. <http://www.enrecahealth.dk>.

³⁶ Keynote speech by Professor Patrus Ananias, Minister of Social Development and Fight against Hunger of Brazil, in the Report of the Standing Committee on Nutrition at its Thirty-Fifth Session, Hanoi, March 2008.

Introduction

Nutrition fundamentally determines *life chances* and people's ability to convert *opportunities into outcomes*. The Universal Declaration of Human Rights stipulates that every individual has the right to food³⁷. This right provides the context within which nutrition policies and programs can thrive. Improved human nutrition is "a moral imperative and a precondition for sustainable development"³⁸.

It is difficult to see how it would be possible to meet the MDGs without proactively dealing with undernutrition (see Box 1); *it is, essentially, a foundation for their attainment*. Undernutrition retards the achievement of other human, economic and social development goals. It is also an inter-generational problem. A stunted young girl is likely to become a stunted adolescent and later a stunted woman.³⁹ Besides posing threats to her own health and productivity, poor nutrition in her adult life increases the chance that her children will be born undernourished. *Prevention of undernutrition is therefore a long-term investment which greatly benefits both present and successive generations and preserves human capital.*

BOX 1: Nutrition's Contributions to the Attainment of the MDGs

Goal 1 – Eradicate extreme poverty and hunger

- Malnutrition erodes human capital, reduces resilience to shocks and reduces productivity (impaired physical and mental capacity).

Goal 2 – Achieve universal primary education

- Malnutrition reduces mental capacity.
- Malnourished children are less likely to enrol in school or more likely to drop out.
- Current hunger and malnutrition reduces school performance.

Goal 3 – Promote gender equality and empower women

- Better-nourished girls are more likely to stay in school and to have more control over future choices.

Goal 4 – Reduce child mortality

- Malnutrition is directly or indirectly associated with more than 35% of all child mortality.
- Malnutrition is the main contributor to the burden of disease in the developing world.

³⁷ The 1948 Universal Declaration of Human Rights states that 'Everyone has the right to a standard of living adequate for the health and well-being of himself and his family, including food, clothing, housing and medical care and necessary social services, and the right to security in the event of unemployment, sickness, disability, widowhood, old age or other lack of livelihood in circumstances beyond his control' (Article 25.1).

³⁸ Eide, W B, 2002, Nutrition and Human Rights. In *Nutrition: A Foundation for Development*, Geneva: ACC/SCN.

³⁹ Leroy, J L et al, 2008, The Oportunidades Program Increases the Linear Growth of Children Enrolled at Young Ages in Urban Mexico, *American Society for Nutrition J. Nutr.* 138:793-798.

BOX 1: Nutrition's Contributions to the Attainment of the MDGs (cont.)**Goal 5 – Improve maternal health**

- Maternal health is compromised by an anti-female bias in allocation of food, health and care.
- Malnutrition is associated with most major risk factors for maternal mortality.

Goal 6 – Combat HIV/AIDS, malaria, and other diseases

- Malnutrition weakens resistance to infections.
- Undernutrition reduces malaria and diarrhoea survival rates.

Source: Adapted from SCN, 2004. *5th Report on the World Nutrition Situation: Nutrition for Improved Development Outcomes*
<http://www.unscn.org/layout/modules/resources/files/rwns5.pdf>

Undernutrition is a pervasive but hidden problem, affecting the poor more than the rich. It is a *manifestation, cause and consequence of poverty*. The prevalence of undernutrition is often two or three times – sometimes many times – higher among the poorest income quintile than among the highest quintile. Improving nutrition is a pro-poor strategy, disproportionately increasing the income-earning potential of the poor.

This paper pulls together the evidence on nutrition, looking specifically at the problem and its interface with emerging policy agendas, the determinants, the impacts, the interventions and the response to date. It was developed as part of a process in which DFID set out to enhance its focus on improved nutrition outcomes. *This evidence informs the development of DFID's strategy to 2015 for tackling undernutrition in the developing world.*

This paper does not set out to provide an exhaustive review of all the relevant and most up to date evidence on undernutrition, nor is it based purely on peer reviewed journals. It cannot do justice to the richness of the debate on some of the facts and figures referred to. It reflects the type of evidence that informs DFID's and others' policy formulation and the major findings. It highlights the broad parameters associated with the nutrition problem and the current state of knowledge. It is important to acknowledge that the quality and sources of evidence vary. There is a reasonable body of evidence on many of the determinants and impacts of undernutrition, and the cost-effectiveness of direct interventions. There is less on how such interventions can be effectively scaled up in different settings. There is more on the 'direct' interventions than on the impact, relative importance and cost effectiveness of indirect interventions that tackle the drivers of undernutrition. DFID's research agenda will contribute towards filling some of the gaps in the evidence.

The problem

Scale

The target set at the 1996 World Food Summit was to halve the number of undernourished people by 2015 from their number in 1990-92. The estimated number of undernourished people in developing countries was 824 million in 1990-92. In 2003-05, the figure stood at 848 million and reached 923 million in 2007.⁴⁰

The MDG 1 hunger target seems very unlikely to be met. In 2007, UNICEF announced that the *prevalence of underweight amongst children less than five years has declined in developing countries from 32% to 27% between 1990 and 2006*.

Black et al (2008) in the new Lancet series estimated that:

- There are a *total of 112.4 million underweight young children globally* – 28 % of whom were in eastern Africa and 33% in south central Asia.
- 13 million infants are born annually with *intrauterine growth restriction (IUGR)* resulting in low birth-weight.
- Worldwide, 178 million children under five years suffer from stunting, of whom 57 million live in Africa, 112 million in Asia and 9 million in Latin America. The global prevalence of stunting in under fives in 2005 was 32%, with rates in Africa, Asia and Latin America averaging 40%, 31% and 16%, respectively.
- 10% of all children globally (55 million) are wasted. 19 million children worldwide suffer from severe acute malnutrition.

In Sub-Saharan Africa, although the prevalence of underweight appears to have dropped (32% in 1990 to 28% in 2006)⁴¹, the number of underweight children is on the increase. It rose from 29 million to 37 million between 1990 and 2003.⁴² The region is expected to be home to about 30% of the under-nourished people in the world by 2015, compared with 20% in 1990-92. In South Asia, both the prevalence (54% in 1990 to 46% in 2006),⁴³ and the number (88 million in 1990 and an estimated 64 million in 2005) are declining only slowly. Figure 1 shows the global trends in underweight to 2005.

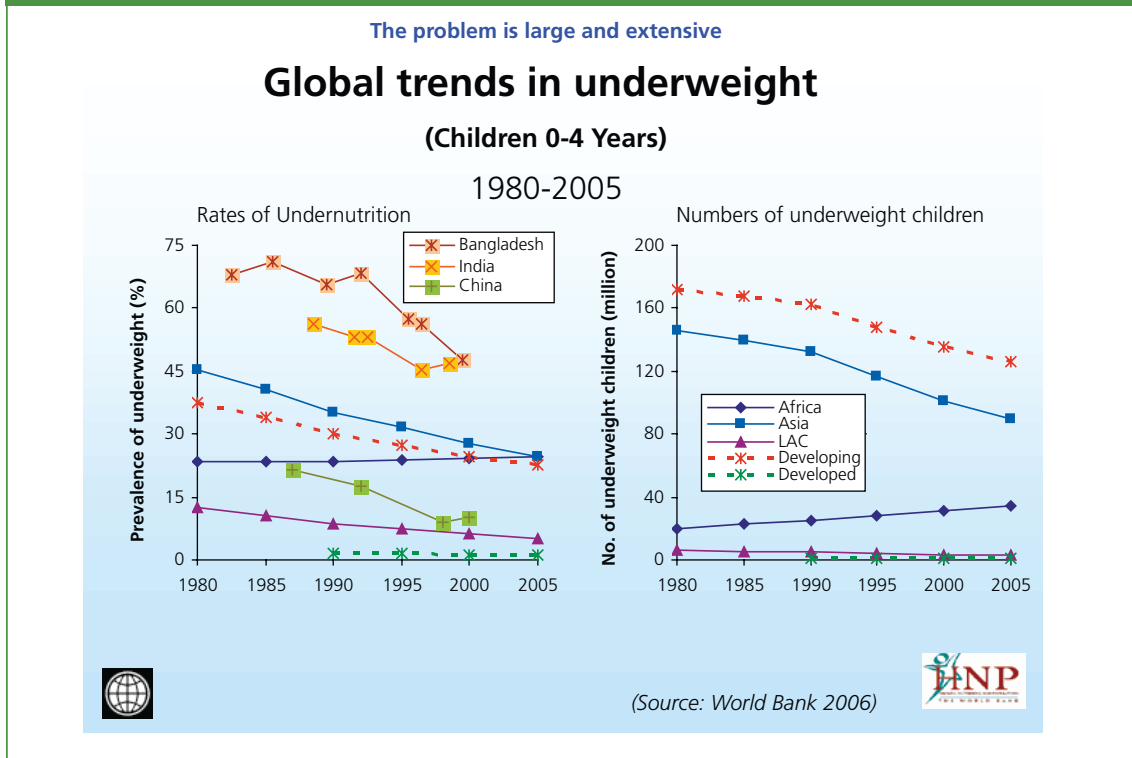
⁴⁰ FAO, 2008, op cit.

⁴¹ UNICEF, 2007, op cit.

⁴² UN, 2005, The Millenium Development Goal Report.

⁴³ UNICEF, 2007, op cit.

Figure 1: Global trends in underweight 1980-2005



Furthermore, evidence is suggesting that overweight coexists in the same countries where both child and maternal undernutrition are widespread and in many countries with low per capita GNP.⁴⁴

Undernutrition is a concentrated epidemic, but of low national priority. *80% of the world's undernourished children live in just 20 countries in the world* (see figure 2). 13 of these 20 countries deem nutrition to be a low priority.⁴⁵

In countries with high economic growth, undernutrition persists or has worsened. At national level, income growth has a steady but slow impact on undernutrition rates. On average, undernutrition rates decline at half the rate GNP per capita increases. In contrast, poverty rates decline at twice the rate of GNP growth per capita⁴⁶. Growth does contribute to improving nutrition outcomes, but the trickle-down effect can be slow. Uneven growth and inequity might contribute to this phenomenon.

⁴⁴ Kennedy, E, 2005, The global face of nutrition: what can governments and industry do?, Journal of Nutrition 135. Monteiro et al, 2004 (in Socioeconomic status and obesity in adult populations of developing countries: a review, Bulletin of the WHO) recognises that the burden of obesity in each developing country tends to shift towards the groups with lower socio-economic status as the country's GNP increases. The World Bank's strategy (Repositioning Nutrition as Central to Development) identifies that trends in overweight among children under five, though based on data from a limited number of countries, are alarming — for all developing countries and particularly for those in Africa, where rates seem to be increasing at a far greater rate (58% increase) than in the developing world as a whole (17% increase) (World Bank, 2006).

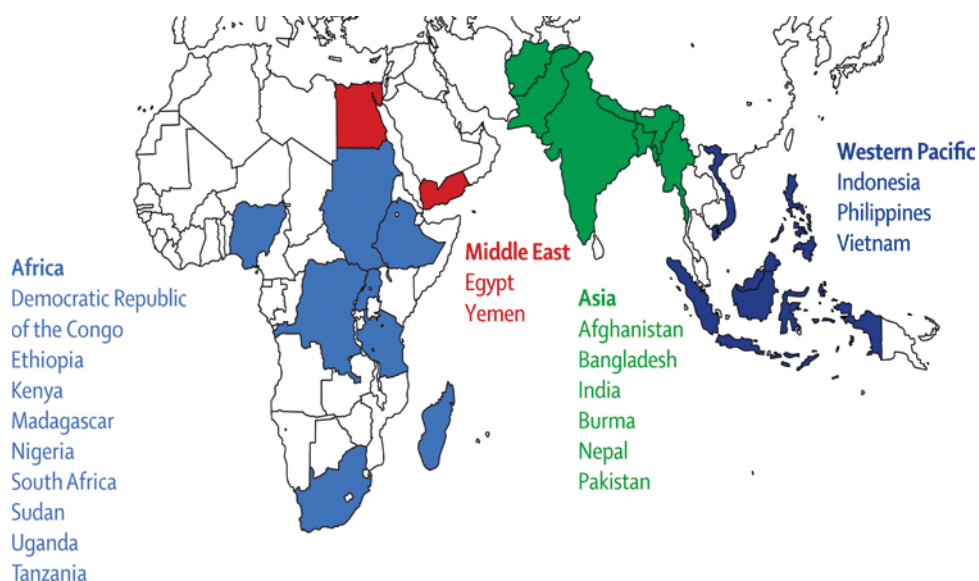
⁴⁵ Bryce J, Coitinho D, Darnton-Hill I, Pelletier D, Pinstrip-Andersen P, for the Maternal and Child Undernutrition Study Group 2008, Maternal and child undernutrition: effective action at the national level, Article 4, Lancet 371:510-26

⁴⁶ Alderman, H.J. Behrman and J. Hoddinott, 2004, Improving Child Nutrition for Sustainable Poverty Reduction in Africa, IFPRI

However, there are examples of economic growth combined with a reduction of poverty (resulting from macro-economic policy reforms) which have been associated with rapid improvements in child nutritional status in many developing countries (e.g. Brazil).

Figure 2: The 20 countries with the highest burden of undernutrition

Countries with stunting prevalence $\geq 20\%$ in children under the age of 5 years that together account for $>80\%$ of the world's undernourished children. Colour denotes region.



Source: Black et al, 2008.

The prevalence of child undernutrition in India deviates further from the expected level at the country's per capita income than in any other large developing country. India is home to 40% of the world's malnourished children and 35% of the developing world's low birth-weight infants. Every year 2.5 million children die in India; over half of these deaths could be prevented if children were well nourished.⁴⁷

Over 35% of preventable deaths among children under 5 years are associated with undernutrition.⁴⁸ Maternal and child undernutrition contributes to 3.5 million deaths every year, and accounts for 11% of total global Disability Adjusted Life Years (DALYs) and 35% of the burden of disease for children under 5 years.⁴⁹ Vitamin A deficiency alone is responsible for 0.5 million of these deaths. Among women, 20% of maternal deaths result from iron-deficient anaemia and maternal short stature, while 1 in 6 children born to undernourished mothers are born with low birth weight.⁵⁰

⁴⁷ von Braun, J.; Ruel, M and Gulati, A., 2008, Accelerating progress toward reducing child malnutrition in India: A concept for action, IFPRI.

⁴⁸ Black et al, 2008, op cit.

⁴⁹ In Disability Adjusted Life Years (DALYs) per 100,000 population. The DALY is a measure of the burden of ill health taking into account reduced life expectancy and quality of life. The number of DALYs lost as a result of a disease is calculated by estimating the number of years lost due to premature death plus equivalent years of ill health.

⁵⁰ Black et al, 2008, op cit.

*The consequences of undernutrition are long-term and irreversible after two years of age, with the physical and cognitive effects of poor foetal growth and/or stunting in the first two years of life being sustained into adulthood.*⁵¹

Undernutrition represents the non-income face of poverty. Though many countries are on-track in improving income poverty (MDG 1a), less than a quarter of developing countries are on-track for achieving the goal of halving undernutrition (MDG 1c).⁵² The little progress that has been made to date is threatened by a series of global trends, such as rising food and oil prices, climate change, and increasing state fragility, conflict and emergencies.

Global crises: high food and oil prices followed by the global economic downturn

The World Bank estimates that as many as 130–155 million more people in the world have been forced into extreme poverty and that for “very poor people, reducing consumption from already low levels even for a short period has severe long-term consequences. Higher food prices during 2008 alone may have increased the number of children suffering permanent cognitive and physical injury due to malnutrition by 44 percent.”⁵³

Rising food prices significantly eroded households’ purchasing power especially of the poorest who already spend high proportions of their household income on food. Those who mostly depend on the market to access food were particularly affected (e.g. urban settlers, poor rural households). Evidence is still being gathered and some remains unpublished. For example, an unpublished WFP commissioned research project studying 3000 households in Ouagadougou revealed that between June 2007 and July 2008 dietary diversity deteriorated significantly as a result of the food crisis. The consumption of nutrient-rich food (measured by a dietary diversity score) significantly decreased: consumption of dairy products fell by 21%, meat fell by 25%, fruits: – by 31%, vitamin A rich vegetables fell by 32%. The field research recorded a 10% increase in the percentage of households severely or moderately food insecure.

The loss of purchasing power also affected households’ ability to buy other goods and services, including heating, lighting, water, sanitation, education, and health care, all of which are important inputs into nutrition.⁵⁴

⁵¹ Victora et al, 2008 op cit.

⁵² World Bank, 2006, Repositioning Nutrition as Central to Development: A Strategy for Large-Scale Action, Directions in Development.

⁵³ World Bank, 2009 a, Global Economic Prospect – Commodities at the Crossroads.

⁵⁴ IFPRI, 2008, High food prices: The what, who, and how of proposed policy actions.

Alongside rising food prices, oil prices have also been increasing and since 2005 have been rising faster than food. Rising oil prices have impacted on many aspects of food production and marketing. Rising oil prices lead to increased cost of fertilizer, as nitrogen fertilizer is derived from oil, but also because of increased transport costs. Increased fuel costs have also increased the cost of operating machinery and transporting food and agricultural inputs.

The negative impact of the high food prices is likely to be further deepened by the economic downturn. Reduced remittances into developing countries, loss of job opportunities and lower wage rates are likely to reduce households' income and purchasing power. The severity and incidence of poverty are likely to increase leading to a rise in undernutrition.

Climate change

The Intergovernmental Panel on Climate Change believes that *"climate change alone is estimated to increase the number of people at risk of hunger to between 40 million and 170 million"*, with more at risk from other socio-economic impacts of the changes⁵⁵. Evidence on the health, food and nutrition impacts of climate change continues to emerge and to be debated.

In a recent paper, Costello et al (2009) map six ways that link climate change to health, including through changing patterns of disease and mortality, extreme events, food, water, concluding that climate change poses *"a real threat to global health wellbeing"*, including nutrition.⁵⁶

It is very likely that climate change and variability will lead *to more intense and longer droughts*. Droughts and water scarcity reduce dietary diversity and overall food consumption, which may lead to undernutrition.⁵⁷ The frequency of rainfall has increased over most land areas. The risk of flooding may increase, from both sea-level rise and increased heavy precipitation in coastal areas. This is *likely to result in an increase in the number of people exposed to diarrhoeal and other infectious diseases, thus lowering their capacity to utilise food effectively*. Climate change is projected to increase the burden of diarrhoeal diseases in low-income regions

⁵⁵ Easterling, W.E., P.K. Aggarwal, P. Batima, K.M. Brander, L. Erda, S.M. Howden, A. Kirilenko, J. Morton, J.-F. Soussana, J. Schmidhuber and F.N. Tubiello, 2007: Food, fibre and forest products. Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson, Eds., Cambridge University Press, Cambridge, UK, 273-313.

⁵⁶ Costello A et al 2009, Managing the health effects of climate change, Lancet and UCL for Global Health Commission, Vol 373: 1693-1733.

⁵⁷ Cohen, M J, Tirado, C, Aberman, N L and Thompson, B, 2008, Impact of Climate Change and Bioenergy on nutrition, IFPRI, FAO, Rome.

by approximately 2-5% by 2020. It is estimated that in Africa, climate change will increase the number of person-months of exposure to malaria by 16-28% by 2100, which will affect food availability, access and utilization and contribute to increased rates of anaemia in pregnancy.⁵⁸

Changes in vegetation on a large scale will affect surface temperatures and alter regional rainfall patterns.⁵⁹ Diminishing and melting mountain glaciers could lead to water shortages and food insecurity. King et al (2007) estimate that a 2°C rise in temperature would lead to 220 million at risk of undernutrition due to reduced agricultural output; a 3°C rise would expose 440 million more to the risk of undernutrition.⁶⁰ Modelling suggests that crop yields will increase at mid to high latitudes and decrease at low latitudes; therefore, in food-insecure populations this may already be contributing to undernutrition.⁶¹ The frequency and severity of production shortfalls are projected to increase due to climate change, thereby increasing food prices even further.

Fragility, conflict and emergencies

State fragility results in reduced access to basic needs and increased threats to life. The burden of disease and mortality borne by fragile states is high: one in three of their people are undernourished.⁶²

Emergencies are often characterized by a high prevalence of acute malnutrition and micronutrient deficiency diseases, which in turn lead to increased risk of morbidity and mortality among the affected population and in particular among vulnerable groups. In the early stages of refugee emergencies, undernutrition is common, increasing the risk of disease and death.⁶³ A survey carried out in the Republic of Congo at the end of 1999, for example, found that mortality rates were high and malnutrition was a principle cause of death among the displaced, with 1/3 of all children in a camp in Brazzaville suffering from acute malnutrition.⁶⁴

⁵⁸ *ibid.*

⁵⁹ Defries, R.S., L. Bounoua and G. J. Collatz, 2002, "Human Modification of the Landscape and Surface Climate in the Next Fifty Years", *Global Change Biology*, 8, 438-458.

⁶⁰ King, D, *The Science of Climate Change*, 2007.

⁶¹ Perrin, N, *Health Consequences of Climate Change*, 2007. Opinions vary. Some evidence suggests that increased CO2 emissions might increase production.

⁶² Eldis Meeting the health MDGs in fragile states <http://www.eldis.org/go/topics/dossiers/health-and-fragile-states/introduction-health-in-fragile-states/meeting-the-health-mdgs-in-fragile-states>.

⁶³ WHO, 2003 cited in *World Hunger Notes*, 2009 http://worldhunger.org/articles/Learn/world_hunger_facts_2002.htm.

⁶⁴ Salignon et al 2000, *Health and war in Congo Brazzaville*, *Lancet* Vol 356 Issue 9243, Page 1762.

Investments in nutrition can be tools for crisis prevention, mitigation, and management for three reasons:

- Lack of access to food may trigger social unrest and conflicts;
- Good nutrition decreases the human vulnerability that transforms systemic shocks into humanitarian disasters; and
- Good nutrition lowers the death rate and promotes timely return to equitable and durable development in the aftermath of crises.⁶⁵

Natural disasters and armed conflict can limit the effectiveness of nutrition interventions, for example by reducing local availability and quality of food, access to clean drinking water, and adequate health care.

⁶⁵ Administrative Committee on Coordination Sub-Committee on Nutrition (ACC/SCN), 2002, Nutrition: A foundation for development, UN.

The Determinants

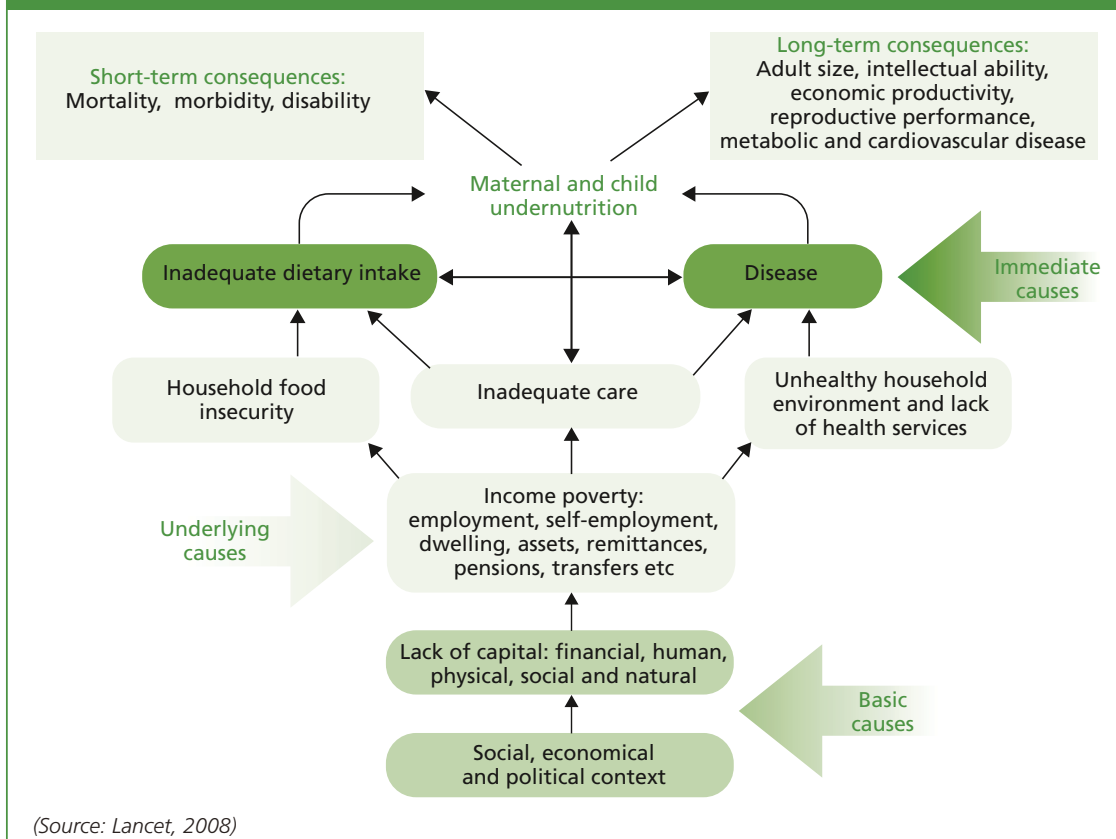
*Undernutrition arises from complex, multiple, interactive causes, both direct and indirect.*⁶⁶ The framework presented in Figure 3 is a simplified representation of the types and levels of causes leading to undernutrition. It distinguishes between causes operating at three levels: immediate, underlying and basic causes.⁶⁷

The two immediate causes are inadequate dietary intake and disease. People can become undernourished either because they do not eat sufficient food of the appropriate form or quality or because they are sick. Illness depresses a person's appetite and inhibits the absorption of nutrients. It also diverts nutrients away from contributing to a child's growth and toward fighting the illness.

Beyond this, underlying causes operate at household and community levels. They are clustered into three categories: household food security, care for children and women and health environment/ health services, with income poverty underpinning all three. Ultimately, these factors are embedded in the larger political, economic, social and cultural environment, known as the basic causes. Undernutrition reflects and contributes to inequality, disproportionately affecting poor, marginalized and extremely vulnerable groups. In this framework, for example, women's status can be considered both an underlying and a basic cause of child undernutrition.

⁶⁶ Kurz, K and Johnson-Welch, C, 2001, Enhancing women's contributions to improving family food consumption and nutrition, Food and Nutrition Bulletin 22 (4).

⁶⁷ Black et al. op cit based on UNICEF, 1990, Strategy for improved nutrition of children and women in developing countries.

Figure 3: Malnutrition causal framework and consequences

This section looks at each major known determinant in turn.

Food Security

World agriculture produces 17% more calories per person today than it did 30 years ago, despite a 70% population increase. This is enough to provide everyone in the world with at least 2,720 kilocalories (kcal) per person per day⁶⁸, 500 Kcals over the 2,200 Kcals per day requirement. The principal problem at the individual level is that many people in the world do not have sufficient land to grow, or income to purchase, enough food. However, even at the global level there is no room for complacency. The World Bank estimates that global food production needs to increase by 50% by 2030 to meet additional demand from a bigger population and predicted dietary changes.⁶⁹

Nutrition-security and food self-sufficiency are not the same. Many countries have achieved “food self-sufficiency”, which simply means they are not net food importers, but have not achieved nutrition security. Ghana, Uganda, and Nigeria are meeting their national food supply needs, yet they have a large proportion of

⁶⁸ World Hunger Facts 2009 at <http://www.worldhunger.org/articles/Learn/world%20hunger%20facts%202002.htm>

⁶⁹ Reported in Cabinet Office News Release: Government sets out 21st century challenges for food in the UK, UN Secretary General Statement (June 3rd 2009). http://www.cabinetoffice.gov.uk/newsroom/news_releases/2008/080707_food_report.aspx

children who are underweight.⁷⁰ India is classified as food self-sufficient but has among the highest underweight prevalence rates in the world. While Africa carries the largest burden of national food imports and food-related emergencies, South Asia has the highest rates of under-weight in the world.

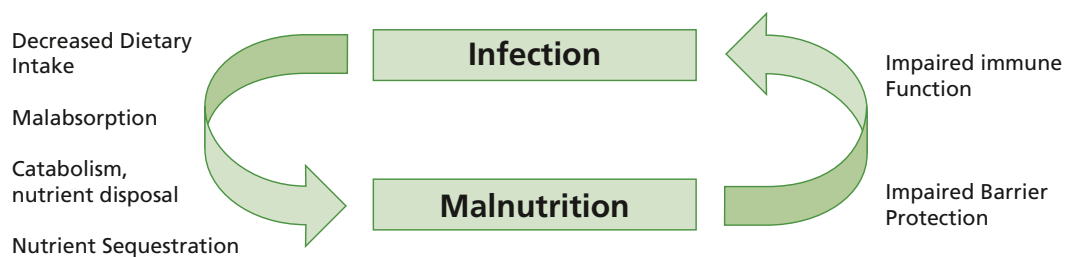
Household food security depends on the ability of the household to produce or procure enough food to ensure an adequate diet for all its members at all times. Farmers living on marginal lands, landless or temporary labourers, pastoralists, small-scale fishermen and forestry workers and the urban poor are most vulnerable to food insecurity. They may experience chronic, seasonal or transitory food shortages.

While *food insecurity is acknowledged as a cause of undernutrition, the exact relationship between the two is not well understood*. This is partly because of the difficulties associated with measuring the food-related causes of undernutrition.⁷¹ Furthermore, progress made in measuring food insecurity has largely involved measuring access to food energy, rather than aspects of dietary quality. Even if a person consumes enough calories, this does not guarantee adequate intake of essential micronutrients – vitamins, minerals and trace elements.⁷²

Health and Sanitation

The *relationship between nutrition and infectious disease is a synergistic one*: infections result in decreased dietary intake and the malabsorption of nutrients, leading to undernutrition, which itself reduces children's resistance to infection, thus increasing the likelihood of repeat infections (see Figure 4).

Figure 4: The Synergistic Relationship between Infection and Nutrition (adapted from Brown, 2003)



(Source: Brown, K.H., 2003, *Diarrhoea and Malnutrition*, *Journal of Nutrition* 133:328-332)

⁷⁰ Johnson-Welch, C; MacQuarrie, K and Bunch, S, 2005, A leadership strategy for reducing hunger and malnutrition in Africa: the agriculture-nutrition advantage, International Centre for Research on Women.

⁷¹ Discussed in Chastre et al, 2007, op cit.

⁷² Cohen et al, 2008, op cit.

The effect of infections on the nutritional status of young children is well documented⁷³ and appears to be directly proportional to the severity of infection.⁷⁴

Environmental health risks and nutrition

Sector experts assess that some 50% of the consequences of undernutrition may be caused environmental factors, including a lack of access to safe water and sanitation and/or poor hygiene practices⁷⁵ that leads to exposure to repeated enteric infections (with diarrhoea, intestinal parasites) or malaria.

Where such infections are not lethal, evidence suggests that exposure to water-related diseases, particularly helminths, in early infancy still leads to irreversible growth faltering, lowered immunity and increased morbidity.⁷⁶

Enteric infections increase risk and severity of undernutrition via a number of different mechanisms. There is increasing evidence for enteric infections to cause damage to the gut-lining leading to malabsorption, even in the absence of pathogenic indicators of disease.⁷⁷

Diarrhoea and nutrition

Diarrhoea is one of the biggest infectious disease killers of children under 5 in the developing world, directly resulting in 1.5 million deaths and 52,460 lost DALYs every year.⁷⁸ The symbiotic relationship between undernutrition and diarrhoea is well established: the undernourished are more likely to suffer longer bouts, higher incidence of and increased mortality rates from diarrhoea, while those suffering from diarrhoea are more likely to suffer from wasting, stunting and associated impacts such as decreased cognitive development. The most serious forms of malnutrition (severe acute) is often caused by bad sanitation and disease leading to diarrhoea especially among young children.⁷⁹

Examples of impact of diarrhoea on undernutrition are referenced in the World Bank's review of environmental health and child survival (2008):

- An average of 9.1 episodes of diarrhoea before the age of 2 was associated with an average growth faltering of 3.6cm by 7 years among children in Brazil.⁸⁰

⁷³ Prüss-Ustün & Corvalán, 2006 cited in World Bank, 2008, Environmental Health and Child Survival: Epidemiology, Economics and Experience .

⁷⁴ Powanda and Beisel, 2003, Metabolic effects of infection on protein and energy, Journal of Nutrition 133 in ibid

⁷⁵ World Bank Environmental Burden of Disease Series, No. 12; Prüss-Ustün A, Corvalán C. (2006) Preventing disease through healthy environments. Towards an estimate of the environmental burden of disease, WHO.

⁷⁶ ibid.

⁷⁷ For example a study by Lunn in the Gambia (2000).

⁷⁸ In UNESCO, 2009, Water's many benefits, Chapter 6 of 3rd UN World Water Development Report, 2009 adapted from Adapted from Prüss-Ustün and Corvalán 2006; Prüss-Ustün et al. 2008.

⁷⁹ World Bank, 2006, How Serious Is Malnutrition and Why Does It Happen? Repositioning Nutrition.

⁸⁰ Moore, S et al 2001 Early childhood diarrhoea and helminthiasis associate with long-term linear growth faltering, International Journal of Epidemiology, 30: 1457-1464.

- A pooled analysis of 9 studies (data covered a 20-year period and five countries) showed that a higher cumulative burden of diarrhoea increases the risk of stunting.⁸¹

Intestinal helminth infection and nutrition

Roughly one third of the world's population harbours intestinal helminth infections at any moment in time, the vast majority of the burden occurring in school-aged children.⁸² These infections, resulting from poor water, sanitation and hygienic practice, can lead to or compound malnutrition via a variety of mechanisms including anorexia (likely the most significant contributor), decreased absorption and direct nutrient (especially iron) loss.⁸³

While the major burden of helminth infections is in school-age children the adverse nutritional impacts of infection are likely most pronounced in pregnancy and early childhood. Over 40 million women suffer from hookworm infection during pregnancy which results in iron, total energy and protein deficiency (as well as possibly folate and zinc), which in turn lead to anaemia, low pregnancy weight gain and associated intrauterine growth retardation and low birth weight, the growth impacts of which are largely irreversible. While less research has explored the impacts of helminthiasis in early life, one study from Brazil found that helminth infection in the early years resulted in a 4.6cm growth shortfall at age seven years.⁸⁴

Malaria and nutrition

The bulk of research conducted on this relationship explores the impacts of malaria in pregnancy, infection being found to result in low birthweight babies due to placental infection and/or malaria induced maternal anaemia. It is suggested that as many as 400,000 pregnant women may have developed severe anemia as a result of infection with malaria in sub-Saharan Africa in 1995.⁸⁵

HIV/AIDS and nutrition

HIV and AIDS interacts negatively with undernutrition. The HIV epidemic largely overlaps with populations already experiencing low diet quality and quantity⁸⁶ HIV infection can lead to nutritional deficiencies through reduced appetite, decreased food intake and malabsorption, which hasten the onset of AIDS. Individuals recovering from opportunistic infections have substantial extra energy requirements

⁸¹ Checkley et al., 2008, Multi-country analysis of the effects of diarrhoea on childhood stunting.

⁸² Brown, 2005, *Medicine* Vol 33, Issue 8 p 54-57.

⁸³ Stephenson LS, Latham MC & EA Ottesen, 2000, Malnutrition and Parasitice Helminth Infections. In *Parasitology* v121: S23-S38.

⁸⁴ Moore, S et al 2001 Early childhood diarrhoea and helminthiasis associate with long-term linear growth faltering, *International Journal of Epidemiology*, 30: 1457-1464.

⁸⁵ Guyatt, H and Snow RW, 2001, *American Journal of Tropical Medicine and Hygiene* 64.1, pp 36-44.

⁸⁶ Ivers, L.C. et al, 2009, HIV/AIDS, undernutrition and food insecurity, *Clinical Infectious Diseases* 2009;49:1096–1102.

of between 10 – 30% extra in adults and 50 – 100% in children.⁸⁷ The economic impact of HIV/AIDS on households (loss of ability to labour, increased expenditure and time spent caring for the sick) can lead to food and nutrition insecurity. This in turn can increase the risk of HIV infection and undermine the effective treatment.

In the short term, poor food intake reduces adherence to anti-retroviral treatment among AIDS patients who are poorly nourished when they begin treatment⁸⁸, improved consumption diminishes adverse side-effects (e.g. nausea) of ARV consumption.⁸⁹

Care

Care is defined as “the provision in households and communities of time, attention, and support to meet the physical, mental, and social needs of the growing child and other household members.”⁹⁰ Although the actual *amount of food ingested by a child is closely related to food security, it is critically dependent on the care-related feeding behaviours of the child’s caretaker*, such as breastfeeding, complementary feeding and food preparation.⁹¹

Breastfeeding, for example, is essential for infants, providing them with a source of balanced nutrition and precious antibodies against disease. WHO estimates that “a lack of exclusive breastfeeding during the first 6 months of life contributes to over a million avoidable child deaths each year”.⁹² For instance, a DFID funded research in Ghana showed that 22% of newborn deaths could be prevented by starting to breastfeed within the first hour of birth. Four million babies in the developing world die each year in the first month of life.⁹³

The ability of caretakers, usually mothers, to provide care to children ultimately rests upon the quality of the care they themselves receive and the time available to them.

Income poverty

A recent World Bank publication reviewing data from 50 developing countries called attention to the economic dimension and inequities at stake in undernutrition. For instance, *the prevalence of stunting increases with poverty, and*

⁸⁷ UNAIDS Policy Brief, May 2008, HIV, Food Security and Nutrition
http://data.unaids.org/pub/Manual/2008/JC1515_policy_brief_nutrition_en.pdf

⁸⁸ Etard JF, Delaporte E et al, 2006, Mortality and causes of death in adults receiving HAART in Senegal: a 7-year cohort study Thirteenth Conference on Retroviruses and Opportunistic Infections, Denver, abstract 556. Paton NI et al, 2006, The impact of malnutrition on survival and the CD4 cell response in HIV-infected patients starting antiretroviral therapy. HIV Medicine 7: 323–330.

⁸⁹ Edstrom, J., Samuels, F., June 2007, HIV, nutrition, food and livelihoods in Sub-Saharan Africa: Evidence, debates and reflections for guidance, Report produced for DFID.
<http://www.eldis.org/vfile/upload/1/document/0812/DFIDAIDSLivelihoods.pdf>

⁹⁰ World Health Organisation, 1992, Nutrition: the global challenge: International conference on nutrition 5-11 December 1992, Rome.

⁹¹ WHO, 1999, A critical link: Interventions for physical growth and psychological development. A review.

⁹² 10 facts on breastfeeding, WHO, July 2009.

⁹³ DFID Research Strategy 2008–13.

*severe stunting is almost three times higher amongst the poorest wealth quintile (18.0%) compared to the richest wealth quintile (6.2%).*⁹⁴ Income poverty limits the options parents have for properly caring for their children. Furthermore, while the main causes of malnutrition appear to change as a child grows, the links between child undernutrition and household wealth remains strong.

There have been few studies that examine whether communities are able to secure enough resources to feed their children properly with the *quality* of diet necessary to ensure healthy growth and development. In 2006, Save the Children initiated a pilot research programme to quantify the extent to which households could afford to feed their children under the age of 2, and a whole family of 5 people, with a diet meeting minimum requirements of macro and micronutrients in selected communities in Bangladesh, Myanmar, Ethiopia and Tanzania.⁹⁵

The research by Chastre et al (2007) found that in 2006/2007, in Ethiopia and Myanmar the minimum cost of the diet for the entire household was above a dollar a day (US \$1.27 and US \$1.15 respectively); in Tanzania and Bangladesh, the estimated costs were 72 cents and 91 cents respectively. In practice, the minimum cost of a healthy diet is likely to be higher than the results presented in this report due to environmental and cultural factors. However, even with the conservative estimates presented, the diet remains unaffordable for large proportions of the population.⁹⁶ This research was carried out before the economic crisis.

Once estimates take into account basic non-food items needed for households to maintain a minimum standard of living, a healthy diet would become unaffordable for the majority of the population in all four locations. In all four, large proportions of children do not receive the frequency of feeding and dietary diversity they need. The findings also point to marked seasonal variation in costs, which has important implications for the cash flow of poor families who often do not have a steady income through the year.

Gender inequality and social exclusion

Women play a leading role in all three areas of food, health and care and in use of nutrition information in the household. They are also responsible for a substantial portion of global food production. The *socially constructed gender roles of men and women interact with their biological roles to affect the nutrition status of the entire family and of each gender.*⁹⁷

⁹⁴ Gwatkin, RD, 2007, Socio-economic differences in health, nutrition and population within developing countries: An overview, World Bank.

⁹⁵ Chastre et al, 2007, op cit.

⁹⁶ Gwatkin, 2007, op cit.

⁹⁷ Oniang'o, R and Mukudi, E, 2002, Nutrition and gender, UN ACC/ SCN.

An extensive IFPRI study explores the relationship between women's status and children's nutrition.⁹⁸ The study defines women's status as "women's power relative to men. Women with low status tend to have weaker control over household resources, tighter time constraints, less access to information and health services, poorer mental health, and lower self-esteem." Such factors result in a clear negative effect on children's nutritional status everywhere, though the strength of the influence of maternal status and the way it influences infant nutrition varies across regions⁹⁹.

As Smith et al (2003) states:

- "in South Asia, increases in *women's status have a strong influence on both the long- and short-term nutritional status of children, leading to reductions in both stunting and wasting*. The human costs of women's lower status in the South Asia region are high. The study estimates that if women and men had equal status, the under-three child underweight rate would drop by approximately 13 percentage points, meaning 13.4 million fewer undernourished children in this age group alone" (see box 2).
- "In Sub-Saharan Africa too, women's status and the long- and short-term nutritional status of children are linked. If women and men enjoyed equal status, child undernutrition in the region would decrease by nearly 3% — a reduction of 1.7 million undernourished children under three."
- "Latin America and the Caribbean exhibit a different pattern from that of South Asia and Sub-Saharan Africa. Women's status has a positive effect only on children's short-term nutritional status and only in those households in which women's relative decision making power is very low."

Female literacy is now widely recognised to be an important determinant of the health of a nation. An educated woman is 50% more likely to have her children immunised against childhood diseases and an infant born to an educated woman is much more likely to survive until adulthood.¹⁰⁰

An analysis of countrywide household surveys in India, Pakistan and Sri Lanka showed that in each country, illiterate mothers are associated with the highest incidence of child undernutrition in every case. *Even women who have gone to primary school but not gone beyond this level can have as much as 20% less undernutrition among their children than illiterate mothers.*¹⁰¹

A range of studies, largely focused on India, show that nutritional allocations

⁹⁸ Smith, L., U. Ramakrishnan, A. Ndiaye, L. Haddad, and R. Martorell, 2003, The Importance of Women's Status for Child Nutrition in Developing Countries, Research Report 131, IFPRI.

⁹⁹ Ibid.

¹⁰⁰ Gage, A.; Sommerfelt, E.; Piani, A. 1997. "Household Structure and Childhood Immunization in Niger and Nigeria". *Demography*, 34 (2).

¹⁰¹ Osmani, 1997, in Ramachandran, 2008, Underfed, underpaid, overlooked, Gatekeeper 136: February 2008, IIED.

(within and outside the household) are often biased against female children. In 1985, Amartya Sen concluded that the bias was most prevalent among the landless, asserting also that even minimal land reform yielded substantive results. In a large scale household study in rural India using anthropometric measures, Pal (1999) found strong correlations between the birth order of a child and its level of nutrition.¹⁰² Later born female children were found to be the most discriminated against within the household, though a similar bias was not found for later born male children. Pal also found that increasing levels of literacy did not automatically alleviate the bias against female children.

It is often difficult to assess gender disparity in access to food within the household, as differences in calorie consumption (the standard method of accessing food intake) may be attributed to the lower energy needs of women.¹⁰³ However, many intra-household inequalities manifest themselves most clearly in access to food, care and health. A study of 11 villages in Punjab found that though boys and girls had roughly similar calorie intake, girls were given more cereals, while boys were given more milk and fats with their cereal.¹⁰⁴

Box 2: The South Asia story according to Smith, 2003

“Among the developing-country regions, South Asia’s particularly high child malnutrition rate has remained a puzzle. South Asia trails Sub-Saharan Africa, despite surpassing that region’s record on many of the determinants of child nutritional status – national income, democracy, food supplies, health services, and education. The study indicates that three broad socioeconomic factors help explain this:

- women’s status
- lack of sanitation
- urbanization

Women’s status makes by far the greatest contribution to the regional gap in children’s nutritional status. It plays this role not only because it is lower in South Asia than in Sub-Saharan Africa but mainly because its positive impact is stronger in South Asia. Key areas of discrimination against women in the region include lack of access to security of tenure or ownership of land, invisibility in the workforce and discrimination in access to food.”

The effects of discrimination on the basis of social identity, beyond gender, on nutritional outcomes is little studied. A recent social assessment from India does, however, illustrate the problems and knock-on effects associated with such discrimination (see Box 3).

¹⁰² Pal, S., 1999, An analysis of childhood malnutrition in rural India: Role of gender, income and other household characteristics. *World Development*, 27(7): p 1151-1171.

¹⁰³ Ramachandran, N, 2008, Underfed, underpaid and overlooked: Women, the key to food security in South Asia.

¹⁰⁴ Dasgupta, M. (1987), Selective discrimination against female children in rural Punjab, India. *Population and Development Review*, 13(1):77-100.

Box 3: India: Socio-economic differentials in undernutrition rates (Integrated Child Development Services, 2008)

The underweight prevalence in India is much higher among Scheduled Castes and Scheduled Tribes and has increased over the last 7 years. Muslims also suffer the highest rates of underweight children among all religious communities. DFID India, along with the Government of India (GoI), commissioned a Social Assessment study to understand the contribution of social exclusion to undernutrition. This study will inform the next phase of GoI's flagship nutrition programme, Integrated Child Development Scheme (ICDS). The qualitative study was conducted across 32 villages in four states of Andhra Pradesh, Uttar Pradesh, Rajasthan and Jharkhand. The study found that it was not only geographical distance or knowledge of services that limited access; but institutional discrimination and self exclusion equally contribute to undernutrition. Some key findings from the study included evidence of:

Discrimination on the basis of caste and community in provision of nutrition services – It was found that the nutrition workers don't visit the homes of women belonging to other caste groups. Mostly the service centres were found to be located in the areas of dominant groups (for example Hindu temples), therefore discouraging disadvantaged groups to visit them.

Self exclusion from services – Marginalised communities drop-out of services as they perceive that nutrition workers are callous towards their needs, services are irregular and workers are not interested in their children's welfare.

Prevailing power dynamics – The study illustrates the need to understand the formal and informal relations of power affecting access to nutrition services. Scheduled castes, tribes and religious minorities expressed fear to send children to centres due to social group inter-rivalry. Most excluded groups expressed powerlessness to demand better services from nutrition workers as they were linked to dominant castes and politically powerful families of the villages.

Doubly disadvantaged groups – The study highlighted that a large proportion of the children and women not accessing the ICDS services belong to doubly disadvantaged groups such as girls, lower caste and tribal groups.

Wider equity and cultural considerations

Adequate nutrition is the outcome of *appropriate food and health inputs, mediated through access to safe water and sanitation and positive child-care practices*. There is increasing understanding that all three groups of factors must be addressed: immediate causes, underlying causes and basic causes, *with the reduction of poverty and inequities being an essential part of the basic and underlying causes*.¹⁰⁵ Without focusing on equity, the net gains of interventions on population health and nutrition may not be realized.¹⁰⁶

¹⁰⁵ Darnton-Hill, I; Bloem, M and Chopra, M, 2006, Achieving the Millennium Development Goals through mainstreaming nutrition: speaking with one voice. *Public Health Nutrition*, 9, p. 537-539.

¹⁰⁶ Ergo, A; Shekar, M and Gwatkin, DR, 2008, The prevalence and distribution of malnutrition in low- and middle-income countries, World Bank.

Resolving nutrition deficiencies also requires an understanding of the potential impact of wider cultural factors. For instance, in some African communities, undernutrition is seen as an indication of conflict in the family, such as adultery. In other countries, food taboos and fads are in evidence. In the opinion of the Food and Agriculture Organisation (FAO), “no amount of nutrition education will resolve the problem unless the solution takes into account local beliefs about its cause” and indigenous knowledge related to its possible solution.¹⁰⁷

Overall, the magnitude of effect between the different determinants is little studied. A study by International Food Poverty Research Institute (IFPRI) analysed data from 63 countries based on country fixed-effects multivariate regression, and identified four “underlying” determinants as key factors: water and sanitation, women’s education, women’s relative status, and per capita food availability, along with two other important “basic” determinants: per capita national incomes and democracy. The study was unable to consider the effects of household level food security or poverty (i.e. access to food and income rather than per capita measures) on child undernutrition due to insufficient data.¹⁰⁸

¹⁰⁷ FAO and Sustainable Development Department, July 2001, Gender development fact sheets: Gender and nutrition, http://www.fao.org/sd/2001/PE0703a_en.htm

¹⁰⁸ IFPRI cited in Chastre et al, 2007, op cit.

The Impacts

The long-term consequences of chronic malnutrition are far-reaching. As recognised in the Lancet series (2008), data supports a “*strong association between maternal and child undernutrition and adult short stature, reduced school attendance, and diminished economic potential*”. The impacts are intergenerational.¹⁰⁹

Population

Nutrition and population changes are intimately linked in several ways. First, a population’s ability to nourish itself is a major factor in fertility and mortality rates. Maternal nutritional status affects fecundity, and hence fertility. This relationship has been observed during famines, when birth rates drop markedly. In addition, good nutrition reduces maternal, neonatal, and child mortality. Improved child survival helps slow population growth by increasing birth intervals and reducing the demand for large families. A situation of fewer pregnancies, in turn, reduces the risk of maternal death.¹¹⁰

Health outcomes

As detailed in the problem and determinants section, *undernutrition is a major risk co-factor for disease* and contributes to a large burden of illness, especially amongst children.

Undernutrition weakens the immune system and generally makes a person more susceptible to infections, including diarrhoea. The risk of death in children under 5 years of age – from infections such as acute respiratory infections, malaria and diarrhoeal diseases – increases exponentially as their underweight status becomes more severe.¹¹¹

In 2004, the disease burden for children under 5 equated to an estimated 150 million years of healthy life lost. This was more than five times that for malaria (some 29 million years of healthy life lost).¹¹² See Table 1.

¹⁰⁹ Bird, K, 2007. The intergenerational transmission of poverty: An overview, ODI/CPRC working paper 99. Harper, C., Marcus, R., Moore, K. (2003) Enduring Poverty and the Conditions of Childhood: Lifecourse and Intergenerational Poverty Transmissions. World Development Vol. 31. No 3. pp 535-554.

¹¹⁰ AAC/SCN, 2002, op cit.

¹¹¹ Pelletier DL, et al, 1994, A methodology for estimating the contribution of malnutrition to child mortality in developing countries. Journal of Nutrition, 124: 2106S–225S.

¹¹² Estimates based on WHO Global Burden of Disease 2004 updated using the following assumptions: 35% of under 5 DALYs and Deaths attributable to nutrition (Source: Lancet). *It must be remembered that undernutrition is a risk factor for malaria.*

Table 1: The contribution of undernutrition to the disease burden of under 5s and women

(Estimates based on WHO Global Burden of Disease 2004 updated using the following assumptions: 35% of under 5 DALYs and Deaths attributable to nutrition (Source: Lancet) and 3.4m DALYs and 20% of maternal deaths attributable to iron deficiency anaemia)

Disease/Risk Factor	Disability Adjusted Life Years. Total No (%)	Estimated no of deaths – based on 2004 figures. Total No (%)
Under 5s		
Total All Causes	434m (100%)	10.4m (100%)
Nutrition (Risk Factor)*	151.9.m (35%)	3.5m (35%)
Neonatal	126.4m (29%)	3.8m (37%)
Lower respiratory infections	63.4m (15%)	1.8m (17%)
Diarrhoea	61.7 (14%)	1.7m (16%)
Malaria	29.3m (7%)	0.7m (7%)
Maternal Health		
Total All Causes (Females Aged 5-59)	404.6m (100%)	7.4m (100%)
Maternal Conditions	38.9m (9.6% of total DALYS for females)	0.527m (7% of total deaths for females)
Iron deficiency anaemia in pregnancy and maternal short stature	3.4m (8.7% of maternal conditions)	0.105m (20% of maternal deaths)

(Source: Lancet)

*Nutrition is a contributing risk factor for other diseases such as lower respiratory infections, diarrhoea, malaria and low birth weight.

In many places undernourishment has two major consequences for women: they never reach their full growth potential and they suffer from anaemia. Both are risk factors in pregnancy. Studies from India and Pakistan found that high levels of anaemia complicate childbearing and result in maternal and infant deaths and low birth-weight infants.¹¹³ India, with 88% of all pregnant women developing iron deficiency anaemia, has the worst-case scenario in this regard. Anaemia impairs human functions at all stages of the life span. Severe anaemia during pregnancy increases the risk of maternal mortality by up to 23% in Asia.¹¹⁴ In areas marked by high undernutrition, undernourished women or adolescent girls give birth to babies that are born stunted and thin.

¹¹³ Ramachandran, 2008, op cit.

¹¹⁴ Ross and Thomas cited in Gillespie, S and Haddad, L, 2003, The relationship between nutrition and the MDGs: A strategic review of the scope for DFID's influencing role, IFPRI (for DFID).

The link between maternal and child undernutrition and adult disease is not as clear. There is solid research indicating that young children who are undernourished and gain weight rapidly later in childhood are at increased risk for chronic disease as adults. At the other end of the spectrum, obesity is a major factor in the rapid rise of non-communicable diseases, including cardiovascular disease and diabetes.¹¹⁵

*Undernutrition compounds HIV positive men, women and children's susceptibility to other infections which then worsens their undernutrition.*¹¹⁶ Lack of proper nutrition also compromises the health status of pregnant and lactating mothers, thereby increasing the chance of mother to-child transmission of the HIV virus.

Cognitive development and education outcomes

Early undernutrition and resultant cognitive-social impairment, while preventable, is irreversible after the age of two years. Undernourishment increases the risk of lower cognitive and school performance, and children are more likely to drop out of school.¹¹⁷

Findings from a longitudinal study in Zimbabwe showed that undernourished preschoolers had, on average, a six month delay in starting school, were 3.4 cm shorter and completed 0.85 grades less schooling as compared with the median child in a developed country.¹¹⁸ A recent multi-country study showed that “for every 10% increase in stunting, the proportion of children reaching the final grade of school dropped by almost 8%. The same study showed that each year of schooling increases wages earned by almost 10%.”¹¹⁹ Children who have been severely undernourished in early childhood suffer a later reduction in IQ by as many as 15 points, significantly affecting schooling achievement.¹²⁰

Various nutritional statuses at pre-natal, early childhood and school years have different impacts on muscle and brain development, cognitive and behavioural abilities linked to learning, and on school absenteeism and learning outcomes (see Table 2 for a summary). In general, undernutrition impairs brain development and cognitive abilities during the early days and can cause delayed enrolment and lower learning outcomes at a later stage. Some effects of undernutrition can be addressed, while others cause permanent damage.

¹¹⁵ Lancet, 2008.

¹¹⁶ *Ibid*; Cohen et al, 2008, op cit.

¹¹⁷ Alderman, H., J. Behrman and J. Hoddinott, 2004, Improving Child Nutrition for Sustainable Poverty Reduction in Africa, IFPRI.

¹¹⁸ Alderman, H; Hoddinott, J and Kinsey, B, 2006, Long term consequences of early childhood malnutrition, IFPRI.

¹¹⁹ Grantham-McGregor, S. et al (2007), ‘Child Development in Developing Countries: Developing Potential in the First 5 Years for Children in Developing Countries’, The Lancet, Vol. 369, No. 9555: 60-70 cited in Chastre et al 2007 The Minimum Cost of a Healthy Diet Findings from piloting a new methodology in four study locations, Save the Children.

¹²⁰ Martorell, 1996.

Table 2: Impact of lack of nutrition on education at various ages

Age (yrs)	Health status	Behavioural status	Impact on education
-9 mths -birth	Slow brain development		Slow cognitive development in the long term
0-2	Stunting, prone to diseases	Less sociable, fearful of immediate environment, clinging to mothers	Poor mental development, less participation in learning activities
2-5	Stunting, partial or full blindness, prone to infectious diseases	Increased apathy, decreased activity, less sociable and interactive	Impaired cognitive development, slow learning, less psychosocial stimulation, less participation in learning activities
5+	Diseases, stunting, wasting, weak muscles	Low energy level, less interaction with parents and peers	Delayed enrolment, attention deficit, learning disability, low learning achievement, grade repetition

Undernutrition can affect cognitive development from *before birth*. When nutritional deficiencies become sufficiently severe, growth processes in all areas of the brain are affected.¹²¹ It has been hypothesized that nutritional deficiencies are more likely to have permanent effects on the brain if they occur during critical periods of brain growth. Worldwide, apart from starvation, iodine deficiency is the leading cause of preventable mental retardation.¹²² During the first two trimesters of pregnancy, deficiencies of micronutrients can damage the developing brain, causing permanent cognitive disability as well as motor, hearing and speech disabilities.¹²³

During the *post-natal period*, lack of nutrition can be associated with poor mental, social and cognitive development. Directly and indirectly these symptoms affect the learning abilities of the child. For example, iron deficient children are often more fearful and more likely to cling to their mothers.¹²⁴ Consequently these children do not explore and interact with their environment to the same extent. This kind of interactive exploration of the environment is essential for children's mental development. Deficits in infancy are carried through at least to preschool age. Children who were undernourished at 6 months were also less sociable, and those who were less sociable at 6 months had lower development scores at 30 months and poorer verbal comprehension scores at 5 years.¹²⁵

¹²¹ Peeling, A.N., and J.L. Smart, 1994, Review of literature showing that undernutrition affects the growth rate of all processes in the brain to the same extent, *Metabolic Brain Disease*, 9(1): p. 33-42.

¹²² Berbel, P., Obregon, M., Bernal, J., del Rey, F., de Escobar, G., 2007, Iodine supplementation during pregnancy: a public health challenge. *Trends in Endocrinology and Metabolism*, 18(9): p 338-343.

¹²³ Cao, X. Y, X.M. Jiang, Z. H. Dou, M. A. Rakeman, M. L. Zhang, K. Odonnell, T. Ma, K. Amette, N. Delong and G. R. Delong, 1994, Timing and Vulnerability of the brain to iodine deficiency in endemic cretinism. *New England Journal of Medicine* 331 (26): p. 1739-1744.

¹²⁴ Smart, J.L., 1990, Vulnerability of developing brain to undernutrition. *Upsala Journal of Medical Sciences*.

¹²⁵ Whaley, S.E., M. Sigman, M.P. Espinosa, and C.G. Neumann, 1998, Infant predictors of cognitive development in an undernourished Kenyan population. *Journal of Developmental and Behavioural Pediatrics*, 19(3): p. 169-177.

During *early childhood years*, undernutrition can cause permanent brain damage. Various types of physical disabilities can also result from lack of nutrition at this stage, causing behavioural changes not conducive to learning. Irreversible changes to the developing brain can result in permanent impairment of cognitive function. Several effects of iron deficiency in infancy indicate that resulting cognitive impairments may be long term. However, one study in Bangladesh showed that general cognitive abilities and mathematics test scores were related to indicators of recent iodine deficiency, as opposed to chronic deficiency.¹²⁶

A number of studies across Asia and Africa have found that stunted children enrol in school later than other children.¹²⁷ Many children also fail to enrol in schools because of severe mental and physical disabilities resulting from poor nutrition. Vitamin A deficiency affects an estimated 85 million school age children in the world. The WHO estimated that vitamin A deficiency alone causes around 350,000 of new cases of blindness or partial blindness occurring in children each year. School absenteeism is another symptomatic effect of poor nutrition and health on education.

As the Growth Commission (2008) points out, “in a world where cognitive skills are rising in value, *this damage will jeopardise equality of opportunity, and, if widespread, impair a country’s economic potential far into the future.*”

Growth and productivity

The causal link between undernutrition and economic growth runs both ways. The relationship is likely to be non-linear with multiple channels of influence, both direct and indirect. The positive economic impacts of improved nutrition manifest themselves in at least three ways Alderman et al (2006):

(i) *Direct gains in productivity and earnings arising from improvements in physical stature and strength, as well as improvements in micronutrient status.* Alderman et al (2004) present a number of studies that show a significant link between height and earnings; in Brazil a 1% increase in height leads to a 2-2.4% increase in wages; in Zimbabwe a shock to child health resulting in a reduction of a child’s height reduced schooling by 0.4 years and lifetime earnings by 7%; and a study involving a number of countries showed that a 1% gain in height results in a 4-8% gain in wages. They also present a study with data from a number of countries that shows that moving an infant from low birth weight to non low birth weight is associated with increased earnings by 5-10% per year.¹²⁸

¹²⁶ Huda, S.N., S.M. Grantham-McGregor, K.M. Rahman, and A. Tomkins, 1999, Biochemical hypothyroidism secondary to iodine deficiency is associated with poor school achievement and cognition in Bangladeshi children. *Journal of Nutrition*, 129(5): p. 980-987.

¹²⁷ Glewwe, P., and H.G. Jacoby, 1995, An economic-analysis of delayed primary school enrolment in a low income country – The role of early childhood nutrition. *Review of Economics and Statistics*, 77(1): p. 156-169. Jamison, D.T., 1986, Child malnutrition and school in China. *Journal of Development Economics*, 20(2): p. 299-309. Moock, P.R., and J. Leslie, 1986, Childhood malnutrition and schooling in the Terai region of Nepal. *Journal of Development Economics*, 20(1): p. 33-52.

¹²⁸ Alderman et al 2004, op cit.

A World Bank paper in 2006 presents some studies on the impact of the micronutrient status on productivity; eliminating anaemia increases productivity by 5-17% and can account for up to 2% of GDP in the worst affected countries. It also presents the results of a paper on India where productivity losses from stunting, iodine deficiency and iron deficiency amount to 2.95% of GDP. Just under 100 million US dollars in agricultural productivity over 5 years was estimated to be likely to be lost through the lack of effective policies to tackle women's anaemia in Sierra Leone.¹²⁹

Box 4 indicates the impact improved food intake had on economic growth in the UK during Industrialisation.

Box 4: Economic gains through improvement in nutrition – the example of the UK

The Nobel prize in Economy winner, R.W. Fogel estimated the contribution of good nutrition/increased food energy intake to the country's economic growth:

'The combined effect of the increase in dietary energy available for work, and of the increased human efficiency in transforming dietary energy into work output, appears to account for about 50 percent of the British economic growth since 1790.'

'... when the labor input is adjusted for intensity (measured by calories), improved gross nutrition accounts for roughly 30 percent of the growth of per capita income in Britain between 1790 and 1980.'

(ii) *Indirect gains arising from links between nutritional status, schooling and cognitive development, as well as subsequent adult labour productivities.* Alderman et al (2003) outline results that show this; in Zimbabwe malnourished children started school 7 months later than non-malnourished children and completed 0.7 fewer grades: this is associated with a 12% reduction in lifetime earnings.¹³⁰ A similar study in Ghana shows that delayed entry into primary school results in a 3% reduction in lifetime wealth. They also present studies which show that a 0.5 standard deviation reduction in cognitive ability is linked with a 6.5% and 8% decline in wages in Pakistan and Kenya respectively.

¹²⁹ Aguaya, VM et al on behalf of the PROFILES study group in Sierra Leone, 2003, Sierra Leone – investing in nutrition to reduce poverty: a call for action Public Health Nutrition: 6(7), 653–657.

¹³⁰ Alderman, H., J. R. Behrman, J. Hoddinott as part of Health, Human Capital and Economic Growth, 2003, Nutrition, Malnutrition and Economic Growth, WHO.

(iii) *Savings of resources currently directed to health care, disease treatment and other problems associated with malnutrition.*¹³¹ Such resources could be used productively to spur economic growth. Such savings can happen at a household or individual level but can also occur at the national level. At the country level, studies have estimated that preventing micronutrient deficiencies in China and India would save these two countries US\$5 and \$2.5 billion per year, respectively.¹³²

¹³¹ Behrman, JR; Alderman, H and Hoddinott, J, 2004, Copenhagen Consensus – challenges and opportunities: Hunger and malnutrition.

¹³² Shekar, M and Lee, Y-K, 2006, Mainstreaming nutrition in poverty reduction strategy papers: what does it take, A review of the early evidence. HNP discussion paper, Health Nutrition and Population, World Bank.

The Interventions

Over the last ten years, knowledge about what works in terms of nutrition interventions has been strengthened. Insights from nutrition include recognition that *improving the nutrition status of women before and during pregnancy and to improve the nutrition status of infants in the first two years of life is critical*. Both boost the lifetime well-being of the individual and weaken the intergenerational cycle of poverty. In addition, a focus on malnutrition inevitably involves a focus on individuals who are socially disadvantaged and especially vulnerable to risk.

Nutrition interventions and policies are often classified as “direct” and “indirect”. They can also be classified as short or longer term impact focused, or short and long routes out of malnutrition. The relevance of interventions will vary by context and the nature of the malnutrition (that is severe acute, moderate acute or chronic).

Direct nutrition interventions

Direct interventions tend to tackle the immediate causes of undernutrition through the provision of nutrition related commodities and services. The health sector is often seen as responsible for those interventions that tackle micronutrient deficiencies or child survival concerns arising from undernutrition.

The evidence presented here is largely drawn from the recent Lancet series (2008) that conducted a large-scale review of effectiveness of interventions to tackle maternal and child undernutrition. This review was a meta-analysis of both published and unpublished literature, or randomized control trials, supplemented by non-randomized and observational studies. These were reviewed independently by groups for methodology and statistical analysis amongst other criteria. This review has had significant global publicity and is viewed as the most recent gold standard review of impact of direct nutrition interventions. See Box 5 for key messages.

Box 5: Key messages

- Of available interventions, for which enough data is available to measure impact, *counselling about breastfeeding, fortification or supplementation with vitamin A and zinc, and appropriate management of severe acute malnutrition*, have the greatest potential to reduce the burden of child morbidity and mortality
- Improvement of complementary feeding through strategies such as counselling about nutrition for food-secure populations and food supplements, cash transfers, or a combination of these in food-insecure populations could substantially reduce stunting and related burden of disease
- Interventions for maternal nutrition (supplements of iron folate, multiple micronutrients, calcium, and balanced energy and protein) can improve outcomes for maternal health and births, but few have been assessed at sufficient scale
- Available evidence on growth monitoring (without adequate nutrition counselling and referrals) was insufficient for it to be considered an effective nutrition intervention
- School feeding was considered an ineffective tool for addressing undernutrition amongst children under five years of age
- Although available interventions can make a clear difference in the short term, elimination of stunting will also require long-term investments to improve education, economic status, and empowerment of women.

Box 5 lists the interventions for which there is sufficient evidence to demonstrate impact in all 36 high burden countries home to 90% of the global burden of stunting, and also those that should be implemented in specific contexts. These lists are indicative and should be revised in light of future research findings. For instance, more research is needed to better assess zinc status and ascertain the effect of zinc supplementation on nutritional outcomes.

Figure 5: A “Menu of Options”**Interventions with Sufficient Evidence to Implement in All Countries****Maternal and Birth Outcomes**

- Iron folate supplementation
- Maternal supplements of multiple micronutrients
- Maternal iodine through iodization of salt
- Maternal calcium supplementation
- Interventions to reduce tobacco consumption or indoor air pollution

Newborn Babies

- Promotion of breastfeeding (individual and group counselling)

Infants and Children

- Promotion of breastfeeding (individual and group counselling)
- Behaviour change communication for improved complementary feeding
- Zinc supplementation
- Zinc in management of diarrhea
- Vitamin A fortification or supplementation
- Universal salt iodization
- Handwashing or hygiene interventions
- Treatment of SAM

Interventions with Sufficient Evidence to Implement in Specific Situational Contexts**Maternal and Birth Outcomes**

- Maternal supplements of balanced energy and protein
- Maternal iodine supplements
- Maternal deworming in pregnancy
- Intermittent preventative treatment for malaria
- Insecticide-treated bednets

Newborn Babies

- Neonatal vitamin A supplementation
- Delayed cord clamping

Infants and Children

- Conditional cash transfer programs (with nutrition education)
- Deworming
- Iron fortification and supplementation programs
- Insecticide-treated bednets

Source: Bhutta et al, 2008

In these 36 countries, the potential impact on death and disability of implementing at scale the most promising interventions was modelled, concluding that *“child deaths could be reduced by one quarter, the prevalence of stunting at 36 months by one third, and 60 million DALYs could be averted.”*¹³³ 70% coverage with these interventions would reduce deaths by 17% globally and avert 17% of the current global DALYs. Intensified nutrition action in high-burdened countries could lead to the achievement of MDG1 and greatly increase the chances of achieving MDGs 4 and 5¹³⁴.

¹³³ Bhutta et al, op cit

¹³⁴ ibid

The following sections present available evidence on the impact of some of these direct interventions, as well as their cost effectiveness.

Community based nutrition and health services

These include growth promotion and supplementary feeding, which may be implemented through Primary Health Care Clinics or other village community centres. As noted in the recent World Bank strategy “Large-scale child growth promotion programs were established in the 1980s in India’s Tamil Nadu state, Indonesia, Thailand and continue in Bangladesh, Honduras, Madagascar and Senegal. A recent cross-country review of successful programs concludes that they led to an “average fall in young child malnutrition of 1-2 percentage points a year – two to four times the 0.5% rate calculated as the average trend in the absence of such programs.”¹³⁵

An annual expenditure of \$789 million on community based nutrition programmes would yield benefits of around \$10 billion, translating into a benefit-cost ratio of 12.5:1. The World Bank (2006) confirms these findings with significant improvements to nutrition realised through community-based growth promotion costing between \$1.60 and \$10 per participant.

Breastfeeding counselling

Promotion of breastfeeding can take place through individual and group counselling. Breastfeeding has been shown to reduce mortality in infants and young children. Breastfeeding promotion studies indicate that with individual and group counselling, the odds of exclusive breastfeeding were substantially increased in the neonatal period and at 6 months of age. With 99% coverage, breastfeeding promotion is estimated to reduce deaths at 36 months of age by 9.1% and DALYs at 36 months by 8.6%. Although the effect of breastfeeding promotion on survival is large, its effect on stunting is small (see Table 3).

Treatment of Severe Acute Malnutrition (SAM)

Appropriate management of SAM in hospital and community settings using standard criteria significantly improves clinical outcomes and survival. Inpatient treatment is resource intensive and requires many skilled and motivated staff. Where SAM is common, the number of cases exceeds available inpatient capacity, limiting the effect of treatment; case-fatality rates are 20-30% and coverage is under 10%. There does exist, however, clinical management protocols capable of reducing case-fatality rates to 1-5%.

¹³⁵ World Bank, 2006, op cit.

Prevention of SAM by increasing dietary quantity and quality alone is obviously preferable to the need for clinical input. Programmes of community-based therapeutic care (CTC) or Community Management of Acute Malnutrition (CMAM) are also successful, substantially reducing case-fatality rates and increasing coverage rates. These programmes use new Ready to Use Therapeutic Foods; are designed to increase access to services, reduce opportunity costs, and encourage early presentation and compliance – thus making the approach a cost-effective treatment strategy. WHO endorsed this approach in 2007: “Until recently, treatment has been restricted to facility-based approaches, greatly limiting its coverage and impact. New evidence suggests, however, that large numbers of children with severe acute malnutrition can be treated in their communities without being admitted to a health facility or a therapeutic feeding centre...If properly combined with a facility-based approach for those malnourished children with medical complications and implemented on a large scale, community-based management of severe acute malnutrition could prevent the deaths of hundreds of thousands of children”.¹³⁶

A recent randomized control trial in Haiti compared a recuperative approach of treatment for children who became underweight, with one that targeted all children aged 6 months to 24 months with the same food and health services. They found that there were reductions in stunting by 4%, underweight rates by 6% and wasting by 4%, amongst the communities receiving preventive services relative to other groups. The study reinforces the need to target children under 2 years of age with preventive and community nutrition programmes in high burden countries as they can be effective in a short time in reduction of all aspects of undernutrition. However this study did not include a cost effectiveness element.¹³⁷

Micronutrient supplementation and fortification

The Lancet review modelled the benefits of micronutrient interventions on target age groups and shows the significant impact of giving nutrient supplements or fortifying food. Universal coverage of adequate Vitamin A and using zinc for treatment in ORS could reduce deaths and DALYs in children by 10%; fortifying food with iron could save 123,000 DALYs. Recent evidence also shows that micronutrients (calcium with iron and folic acid) could prevent 24% of all maternal deaths.

Providing Vitamin A and zinc supplements to under two-year-olds has a BCR of 17:1, with \$60 million spent annually translating into benefits worth more the \$1 billion. The World Bank (2006) confirms this with Vitamin A Supplements costing between \$1.01 – \$2.55 per participant and Iron Supplementation between \$0.55

¹³⁶ A Joint Statement by the World Health Organization, the World Food Programme, the United Nations System Standing Committee on Nutrition and the United Nations Children’s Fund on Community Based Management of Severe Acute Malnutrition, 2007.

¹³⁷ Ruel et al, Acting early and targeting widely is key to combating Malnutrition in Poor Communities. Haiti Study Overview from “Age preventive Targeting of Food Assistance and Behaviour Change Communication for Reduction of Childhood Undernutrition in Haiti: A Cluster Randomised Trial, IFPRI.

– \$3.17 per participant. The provision of iodized salt and iron has a BCR of 9.5:1, with an annual cost of \$286 million resulting in benefits of \$2.7 billion. This is confirmed by the World Bank with Vitamin A Fortification costing between \$0.69 – \$0.96 per participant, Iron Fortification between \$0.12 – \$0.22 per participant and Salt Iodization between \$0.20 – \$0.50 per participant, with all having significant impacts on nutrition.

Nutrition education/behaviour change programmes

The Lancet review indicated that education strategies alone were most beneficial in populations which have sufficient means to access food, with strongest evidence seen in China and Peru. In food-insecure populations, educational interventions were of benefit when combined with food supplements. Generally, nutrition education has been effective when behaviour modification, rather than information diffusion, has been the goal. Social learning, social marketing and educational entertainment strategies for mass communication have improved nutritional status among low-income groups and others. Maintaining nutrition communication programmes over a long period is essential to sustain meaningful behavioural changes.¹³⁸

The effect of nutrition education will be limited, however, if individuals do not have the means and opportunities to act on that knowledge.¹³⁹ Some nutrition projects recognize and account for this fact. For example, to better suit women's time availability, some have included income-generating activities, or provided agricultural inputs such as seeds.¹⁴⁰

Maternal malnutrition interventions

Maternal nutrient supplementation in developing countries is generally restricted to provision of iron and folic acid (IFA). Change in practice to supplementation with multiple micronutrients (MMN) has been hindered by little evidence of MMN on foetal loss and infant death. The recent SUMMIT study, however, found that infants of women consuming MMN supplements had an 18% reduction in early infant mortality compared with those of women given IFA. Combined foetal loss and neonatal deaths were reduced by 11%. Maternal MMN may therefore form a significant part of strengthening prenatal care programmes.

¹³⁸ FAO and WHO, 1992, op cit.

¹³⁹ O'Donnell, M, 2004, Food security, livelihoods and HIV/AIDS: a guide to the linkages, measurement and programming implications, Save the Children.

¹⁴⁰ MkNelly, 1997; Ayalew et al, 1999; Iannotti and Gillespie, 2002.

Deworming

J-PAL (Abdul Latif Jameel Poverty Action Lab in Boston MIT) has conducted a number of randomised evaluations in this area. For example, a primary school deworming project in Kenya succeeded in increasing school attendance by 10-15 days a year and increasing height by an average of 0.5cms with an estimated cost of \$3.50 per year of education. Similar results were found for a project in Delhi, India where, at a cost of \$2 per year, children gained 0.6kg on average, increasing their school participation by 6.3%. However, once fees are added to the programme a sharp decline in take-up ensues.¹⁴¹

Some studies, however, find less benefit. A synthesis of 34 trials concluded that: “deworming drugs used in targeted community programmes may be effective in relation to weight gain in some circumstances but not in others. No effect on cognition or school performance has been demonstrated.”¹⁴² Where enteric infections are of high endemicity, re-infection may occur too quickly for deworming to significantly impact on nutritional indicators.

School feeding

A Cochrane systematic review found three randomized control trials which showed that school feeding programmes led to an average weight gain of 0.39 kg over non-supplemented children on average over 19 months.¹⁴³ For height, results were mixed; height gain was greater for younger children. In one particular case in Kenya, J-PAL found that a preschool meal intervention increased test scores by 0.4 of a standard deviation and improved school participation by 30%. Another study found that school meals can result in only 1.3kg of weight gain over six years and no significant gain in height.¹⁴⁴

While school feeding programs are often offered as a strategy to address undernutrition, their merit lies in increasing school attendance and not in promoting child growth¹⁴⁵: “school feeding should complement not compete with nutrition programmes for younger children.”¹⁴⁶ School feeding programmes have demonstrated weak impact on growth or micronutrient status of school-age children. For many children, irreversible damage has already occurred by the time they benefit from such programmes.

¹⁴¹ J-PAL, 2008.

¹⁴² Garner, 2008.

¹⁴³ Kristjansson B, Petticrew M, MacDonald, B., Krasevec, J., Janzen, L., Greenhalgh, T., Wells, G., MacGowan, J., Farmer, A., Shea, B. J., Mayhew, A. and Tugwell, P, 2007, ‘School Feeding for Improving the Physical and Psychosocial Health of Disadvantaged Elementary School Children’, Cochrane Database of Systematic Reviews, Issue 1, Article No. CD004676, January.

¹⁴⁴ WFP, 2005.

¹⁴⁵ World Bank, 2008, op cit.

¹⁴⁶ WFP and World Bank, 2009, Rethinking school feeding: Social safety nets, child development and the education sector.

Furthermore, the cost of school feeding programs ranges between \$18 (snacks) and \$40 (meals)/child/year. A school meal program can therefore cost more than what many countries budget for all of the other costs of education or health (e.g. <2\$/capita/year in Ethiopia) and far more than priority nutrition investments.

There is a need, however, to identify school based approaches that have a demonstrable impact on health and nutrition. It is vital to raise levels of education about health and nutrition, including hygiene education, starting at an early age. To ensure impact, however, evidence based approaches should be selected and programme implementation must be of high quality.

Relative impact of direct interventions to tackle under nutrition and their cost effectiveness

The following tables 3 and 4, taken from the Lancet, present a comparison of the impact of a range of direct interventions to tackle undernutrition, with figures highlighted in green to demonstrate significant impact in terms of DALYs. In terms of prioritising in line with findings of proportional impact on mortality of children, then high coverage of general nutrition interventions has the greatest potential to reduce mortality, followed by micronutrient interventions, breastfeeding support and universal Vitamin A coverage. However, to reduce deaths for under 1 year olds, increasing appropriate breastfeeding practices to universal coverage rises in place behind general interventions.

Table 3: Effect of nutrition related interventions on mortality and stunting

Proportional reduction in deaths before				Relative reduction in prevalence of stunting at			Millions (%) of DALYs averted at
	12 months	24 months	36 months	12 months	24 months	36 months	36 months
99% coverage with balanced energy protein supplementation	3.6%	3.1%	2.9%	1.9%	0.5%	0.3%	7.1 (2.8%)
99% coverage with intermittent preventive treatment	2.4%	2.1%	1.9%	1.4%	0.3%	0.1%	4.8 (1.9%)

Proportional reduction in deaths before				Relative reduction in prevalence of stunting at			Millions (%) of DALYs averted at
	12 months	24 months	36 months	12 months	24 months	36 months	36 months
99% coverage with multiple micronutrient supplementation in pregnancy	2.0%	1.7%	1.6%	0.9%	0.3%	0.1%	4.0 (1.5%)
99% coverage with breastfeeding promotion and support	11.6%	9.9%	9.1%	0%	0%	0%	21.9 (8.6%)
99% coverage with feeding interventions (promotion of complementary feeding and other supportive strategies)	0%	1.1%	1.5%	19.8%	17.2%	15.0%	5.5 (2.1%)
99% coverage with vitamin A (including neonatal in Asia)	6.9%	7.1%	7.2%	0%	0%	0%	17.6 (6.9%)
99% coverage with zinc supplementation	1.3%	2.8%	3.6%	9.1%	15.5%	17.0%	10.8 (4.2%)
99% coverage with hygiene interventions	0%	0.1%	0.2%	1.9%	2.4%	2.4 %	0.7 (0.2%)

(Source: Bhutta, Z.A, et al, 2008, *What works? Interventions for maternal and child undernutrition and survival*, The Lancet, Vol 371, Issue 9610, Pages 417-440)

Table 4: Effect of combinations of nutrition-related interventions on mortality and stunting in 36 countries (99% coverage)

Proportional reduction in deaths before				Relative reduction in prevalence of stunting at			Millions (%) of DALYs averted at
	12 months	24 months	36 months	12 months	24 months	36 months	36 months
General nutrition interventions	14.8%	13.9%	13.4%	21.7%	17.8%	15.5%	33.8 (13.3%)
Micronutrient interventions	10.0%	11.3%	12.1%	10.3%	15.9%	17.4%	31.3 (12.3%)
Disease control interventions	3.0%	2.7%	2.6%	3.7%	2.9%	2.7%	6.6 (2.6%)

(Source: Bhutta, Z.A, et al, 2008, *What works? Interventions for maternal and child undernutrition and survival*, The Lancet, Vol 371, Issue 9610, Pages 417-440)

Cost effectiveness

Evidence indicates that the benefit-cost ratios of investing in direct nutrition are high. Based on costs and benefits, the Copenhagen Consensus (2008) initiative selected the provision of supplements of vitamin A and zinc to children in developing countries, to prevent avoidable deficiencies, as the best way of advancing the welfare of developing countries. Three other strategies for improving diets were also named among the top six cost-effective development investments.

Table 5 shows cost-effectiveness ratios for various direct nutrition interventions and for a selection of other health interventions. The nutrition interventions clearly offer particularly good value for money.

Table 5: Cost effectiveness of direct nutrition interventions

Condition	Intervention	Cost-effectiveness (US\$)/DALY
Nutrition	Promotion of breastfeeding	3-11
	Zinc in management of diarrhoea	73
	Vitamin A fortification	33-35
	Vitamin A supplementation	6-12
	Universal salt iodisation	34-36
	Iron fortification	66-70
	Hygiene Promotion	3
	Treatment of severe acute malnutrition (example of Zambia)	(41)*
Example child health & nutrition package	<i>Sustained child health & nutrition programme</i> that can include prenatal care, women's health & nutrition, breastfeeding promotion, complementary feeding, micronutrient supplementation, supplementary feeding with local supplies etc (mix depends on local capacity/conditions)	225
Other health interventions	Traditional Expanded Programme on Immunisation (EPI)	7
	Case management of mild to very severe lower respiratory infections	398
	Family planning programmes	117
	HIV peer education programmes for high risk groups	37
	Antiviral therapy	922 **
	Insecticide-treated bed nets for malaria prevention	11 **
	Directly observed short-course therapy for tuberculosis in endemic areas	301

(Source: Jamison TJ et al. 2006. *Disease Control Priorities in Developing Countries*. * Source: Bachmann M. 2009. "Cost Effectiveness of Community Therapeutic Care for Children with Severe Acute Malnutrition in Lusaka, Zambia". ** Sub Saharan Africa only)

The annual cost of implementing most micronutrient fortification and supplementation programs is very low, and the benefits of reduced mortality and morbidity as well as the increased productivity associated with these programs are very high. Assuming a 3-5% discount rate and including a range of private and social costs, benefits can be anywhere from 6 to 200 times greater than the costs of implementing the programs, depending on the nature of the intervention.¹⁴⁷ SCN had estimated that the direct cost of doing nothing about child hunger and undernutrition adds up to US\$20-30 billion.

¹⁴⁷ Behrman et al., 2004, op cit.

A number of initiatives are currently underway to develop costing models and tools for implementing essential nutrition interventions at scale in high burden countries. REACH (a partnership of UN and other agencies working to end child hunger and undernutrition) estimate an annual resource gap of \$1323 to \$1762 million for preventative actions and \$173 to \$338 million for curative (in Sub Saharan Africa). This would mean the need for \$4040 million in total per year. The World Bank are currently conducting an exercise to generate more precise figures.

Such costings, whilst important for advocacy purposes, are problematic. There will be enormous variations in the levels of estimated costs due to different delivery systems, country-specific characteristics (including reaching the hardest to reach), programme characteristics and costing methodologies.

Indirect interventions to tackle the drivers of undernutrition

According to the Lancet, universal coverage with the full package of proven interventions – mostly direct interventions – at observed levels of programme effectiveness could reduce the prevalence of stunting at 36 months by about one-third in the 36 worst affected countries.¹⁴⁸ However, without attending to factors that support the three pillars of good nutrition, outlined in figure 5, nutrition-only interventions will fall short of ensuring sustainable changes.¹⁴⁹ It is only through concerted efforts to reduce social inequity and poverty, the root cause of malnutrition, that lasting solutions to nutritional problems will be found.

It is imperative therefore to *simultaneously focus on indirect actions in order to reduce poverty and improve livelihoods through mainstreaming nutrition in multiple sectors* such as agriculture, health, social protection, women's empowerment, education, water and sanitation; scaling-up efforts to improve nutrition as part of cross-sectoral initiatives.

However, there is *much less evidence around how indirect interventions map onto nutrition outcomes*. There are several reasons for this. First, such interventions are not necessarily designed with a nutrition objective in mind and hence are not evaluated by this criterion. It is also difficult to ascertain their impact on undernutrition when they are used as preventative measures and/or when a complex causal pathway is involved.¹⁵⁰

Indirect interventions are rarely incorporated in a comprehensive package to address undernutrition. When they are implemented as part of a livelihoods programme, for example, they are not necessarily designed in a way that would maximise their

¹⁴⁸ Bhutta et al., 2008, op cit.

¹⁴⁹ Johnson-Welch et al, 2005, op cit.

¹⁵⁰ EC, 2008, Enhancing EC's contribution to address child and maternal undernutrition and its causes, Background paper for EC seminar.

impact on undernutrition. For instance, irrigation schemes have had mixed nutrition outcomes as the benefits of improved access to food and cash income can be outweighed by greater exposure to water-borne diseases and increased workload for women.

The following sections look at the links between improved nutrition and select indirect interventions in agriculture, social protection, gender equality, school feeding and water and sanitation.

Agricultural productivity and research

The linkages between agriculture and nutrition are complex. Agriculture can help increase access to food and income and therefore good nutrition, and good nutrition builds human capital. Whilst better health is an end in itself, it also is an input for agricultural production, creating a circular pathway between agriculture and nutrition¹⁵¹.

There is, however, a need to better understand the links between agricultural production, food security and nutrition. Larger yields may increase access to food, but mono-crop production or greater quantities of low-nutrient content crops do not necessarily translate to adequate quality with respect to nutrition.¹⁵² Greater yields also do not ensure that all households or every household member has access to that food, and neither do higher household incomes.

Investment in agricultural research and major developments in the technology of food production have led to dramatic increases in food availability across the globe. This can have nutritional benefits. In the case of Bangladesh, for example, the increased production of rice as a result of new rice varieties and the liberalisation of the market were responsible for a decline of about 15–20% in underweight in children aged 6–59 months.¹⁵³

Increasing dietary quality and quantity can be achieved, in part, by *investments in agricultural research that improves the micronutrient value of crops*. Increased production of horticulture products and livestock has in the past been agriculture's main avenue to improve diet quality. Other pathways now include bio-fortification of staple crops and higher levels of vitamins and minerals through crop breeding and biotechnology. Bio-fortification may be more sustainable than supplementation or fortification, as it has lower recurrent costs.¹⁵⁴

¹⁵¹ However, agriculture might also impact negatively on the nutrition status by heavy women's workload leading to poor quality care and undernutrition.

¹⁵² Arroyave, G, 1995, Agricultural and food policies: some concerns regarding their nutritional relevance; CIDA, 2000, Towards a healthy, well nourished world: making the links between agriculture, nutrition, health and the environment.

¹⁵³ Torlesse, 2003. There is also an argument saying that the over focus on rice in Bangladesh to the detriment of other more micronutrients-rich crop is partly responsible for the high levels of undernutrition.

¹⁵⁴ Cohen et al., 2008, op cit.

Technological changes that enhance the nutritional content of food can therefore be of benefit to poor people. However, much will depend on whether improved foods retain other consumption traits (storage, cooking, taste, etc) that are important to the poor, and whether they are more costly or not.¹⁵⁵ The full nutritional benefits of commercialized agriculture can only be realised if prices of food in local markets remain affordable and a diversity of food crops is attained. When planners contemplate introducing cash crops or other farm enterprises, the socio-economic effects must be carefully assessed.¹⁵⁶

Production shortfalls can have a measurable impact on nutrition: the poor luck of being born in a year of low rainfall can leave a child stunted for life. Interventions to raise agricultural productivity include support for irrigation, market access and diversification, land administration and management, agricultural technology, and risk management. Increased production of micronutrient-rich foods such as fruits, vegetables and livestock, can reduce local unit prices, increase incomes, and improve micronutrient status.¹⁵⁷

With a nutrition lens, agricultural practices and policies can be examined to determine if agriculture can have a larger role in reducing undernutrition through micronutrients. Medium-term strategies to increase agricultural productivity and sustainability must also focus on increasing women's access to and control over productive assets such as land tenure and water.

Social protection

Social transfers to protect the chronically food insecure and promote improved livelihoods can be complementary to investments in agricultural productivity and growth. Through their regularity and predictability, social transfers can insure the poor against shocks and stresses, and reduce the need for people to sell assets and engage in risky behaviours for their survival. Every study that quantifies the impact of social transfers on nutrition, hunger or food security identifies a positive impact, although a wide range of methodologies are used, making it difficult to generalise about the size of impact.

Regardless of the type of social transfer programme, *household food spending and consumption* consistently increases. In some cases, social transfers also generate a positive impact on the *supply of food*. Zimbabwe's Protracted Relief Programme generated over two months of additional food supply in an average beneficiary household.¹⁵⁸ This increased expenditure and food availability can translate into improvements in different *nutritional indicators*. For example:

¹⁵⁵ ACC/SCN, 2002, op cit.

¹⁵⁶ FAO and WHO, 1992, op cit.

¹⁵⁷ World Bank, 2008, op cit.

¹⁵⁸ Devereux et al, 2007, cited in Samson et al, The Social and Economic Impact of Cash Transfers, EPRI (for DFID) <http://faqs.hungersafetynet.org/Samson%20-%20evidence%20on%20social%20transfers.doc>

- An extensive assessment of Ethiopia's Productive Safety Net Programme (PSNP) finds that three-quarters of participants consumed a higher quantity and quality of food compared to the previous year.¹⁵⁹
- Participation in Nicaragua's Red de Proteccion Social (RPS) reduced the rate of stunting by 5.3%.¹⁶⁰
- In Bangladesh, BRAC's CFPR programme has led to an improvement in calorie intake from 1632 Kcal per day to 2236 Kcal per day (from below to well above WHO minimum recommended levels).
- In Mexico, 70% of households participating in the Oportunidades programme have shown improved nutritional status.¹⁶¹ Its impact on stunted growth in children has also been impressive, with the growth rate among children aged 12-36 months increasing by one centimetre a child a year, reducing prevalence by 10%.¹⁶²
- Similarly, in South Africa, having a recipient of the social pension in a household has been correlated with a three-to-four-centimetre increase in height among children. As noted in a DFID practice paper briefing, "A study of the unconditional Child Support Grant in KwaZulu-Natal, South Africa, suggests that it has an impact on child height for children who started receiving the grant in their first 20 months of life."¹⁶³

Unlike school meal programmes, social transfers benefit pre-school children and other household members rather than just those in school. High rates of return on social transfers can result from their use in many countries to provide pre-school children with vital nutritional resources.

In many studies, the positive impacts reported exceed those reported from the more typical community-based nutrition programmes such as the Bangladesh Integrated Nutrition Programme.¹⁶⁴

Evidence suggests that a package of interventions, including a medical intervention such as de-worming and an income enhancing intervention such as cash transfers, will have significant impact on nutritional status. This is particularly critical for maternal and infant nutrition where deficits can be most irreversible.

¹⁵⁹ Devereux, 2007, Slater et al, 2006, cited in Samson et al, The Social and Economic Impact of Cash Transfers, EPRI (for DFID) <http://faqs.hungersafetynet.org/Samson%20-%20evidence%20on%20social%20transfers.doc>

¹⁶⁰ Maluccio J. et al., IFPRI, 2004, Impact evaluation of a conditional cash transfer program: the Nicaraguan Red de Proteccion Social, IFPRI.

¹⁶¹ SKoufias and McClafferty, 2000, Is PROGRESA working? Summary of the results of an evaluation by IFPRI, International Food Policy Research Institute No 118, Washington.

¹⁶² DFID, 2005.

¹⁶³ Department of Social Welfare 2004 study of South Africa Child Support Granted cited by Dr Ingrid Woolard at Southern African Regional Poverty Network seminar: The impact of conditional cash transfers on human development outcomes: a review of evidence from PROGRESA in Mexico and some implications for policy debates in South and Southern Africa, Pretoria, 27 January 2005. Cited in DFID practice paper, 2006, Using social transfers to improve human development, Social protection briefing note series number 3. <http://www.DFID.gov.uk/Documents/publications/social-transfers-brief.pdf>

¹⁶⁴ Sridhar, D, and Duffield, A, 2006, A Review of the Impact of Cash Transfer Programmes on Child Nutritional Status and some implications for Save the Children UK Programmes.

As yet, however, there are no tools available to determine how big social transfers should be and what type of social protection measures or package would be optimally required in order to achieve specific nutritional objectives (e.g. the relative efficacy of cash transfers vis-à-vis vouchers; targeting women as beneficiaries of transfers etc.). More research and evaluation work is required in order to maximise the potential of social protection programmes delivering nutrition impacts, including assessments of the viability of coupling transfers with the delivery of micronutrients, supplements and nutrition education.

Gender equality

The different rights, responsibilities and access to decision-making of women and men need to be understood in efforts to improve nutrition. *Women's reproductive, productive and social roles are nutritionally taxing.* Women have a key role to play in food production, distribution and preparation (FAO). The time of greatest nutritional stress for rural women is the pre-harvest period when household stocks and energy intake are low, but the energy demands of agricultural work tend to be highest.¹⁶⁵ Women also have a key role to play in direct interventions.

Examples of successful interventions, in terms of both nutritional outcomes and gender equality, have included enabling women to gain access to new resources, implementing social transfer programs that promote girls' education and health care, introducing technologies that save household labour, subsidising child care for working parents, and initiating programs to improve the nutritional status of adolescent girls and young women.¹⁶⁶

Because of its positive effect on child nutrition, it is estimated that *improvements in women's education were responsible for 43% of the reduction in child malnutrition that occurred between 1970 and 1995*.¹⁶⁷ Improving the availability of food has accounted for only 25%. Data from 25 developing countries suggest that 1-3 years of maternal schooling reduces child mortality by 15%.¹⁶⁸

An example of a community-based food security intervention that has yielded positive nutrition results for women is the Helen Keller home garden program, first applied in Bangladesh. This program has contributed to increased food availability and enhanced nutritional status, especially micronutrient status, of women and girls in participating households. By enhancing incomes, this food security program has also helped empower women economically.¹⁶⁹

¹⁶⁵ Ramachandran, 2006, op cit.

¹⁶⁶ Smith et al, 2003, op cit.

¹⁶⁷ Smith, L and Haddad, L, 2000, Explaining child malnutrition in developing countries: A cross country analysis, IFPRI.

¹⁶⁸ IDRC, 2004.

¹⁶⁹ Oniango and Mukudi, 2002, op cit.

Agricultural policies and programs historically have failed to address women's production oriented constraints, including their lack of access to and control over assets and resources.¹⁷⁰ Rural women alone produce half of the world's food and 60% to 80% of the food in most developing countries, but receive less than 10% of credit provided to farmers. Increasing women's access to the means of agricultural production, such as farming land or fertilizers, farm labour, credit and education, as well as decision-making authority within the household, is crucial to improving their nutritional status and that of their children. In some places, if women had the same access as men to land, seed, and fertilizer, agricultural productivity could increase by up to 20%.¹⁷¹

Water and sanitation

The potential of improved access to safe water and sanitation to improve nutrition through time, money and energy savings (particularly among women and girl-children) is little researched. However, given the World Bank report cited above that suggests that 50% of the consequences of undernutrition may be caused by lack of access to safe water and sanitation and/or poor hygiene practices, it is likely that simply through the averted enteric infections, environmental health interventions may significantly impact nutrition. Appropriate nutritional indicators should be included in water and sanitation programme monitoring.

Evolving approaches to nutrition in emergencies

In situations of conflict and natural disaster where food and/or nutritional emergencies are declared, the international system supports humanitarian responses. Food assistance can take many forms including in-kind food aid, but also cash, vouchers or nutrition-specific programmes. Historically, food assistance has for a variety of reasons been inadequate in both quantity and quality. This is now being redressed to an extent with food aid programmes including nutrition elements, though there are still concerns.¹⁷²

The international community has become more adept at saving the lives of wasted children in the context of catastrophes than in the context of development.¹⁷³ As discussed in the section on SAM, the last 10 years have seen dramatic improvements in standardising the technical approaches to acute malnutrition, in refining these approaches, tying them to standards and targets, and in allowing room for innovation (particularly in the introduction of Ready to Use Therapeutic Foods (RUTFs). Evaluating, documenting and building on these

¹⁷⁰ Feldstein and Poats, 1989; Whitehead, 1994, cited Johnson-Welch, C; MacQuarrie, K and Bunch, S, 2005, A leadership strategy for reducing hunger and malnutrition in Africa: the agriculture-nutrition advantage, International Centre for Research on Women.

¹⁷¹ Women Thrive Worldwide, 2008.

¹⁷² International Development Committee, 2008, The World Food Programme and global food security.

¹⁷³ Gross, R and Webb, P, 2006, Wasting time for wasted children: severe child undernutrition must be resolved in non-emergency settings, The Lancet Vol 367 April 8.

experiences will enable further progress on the creation of a minimum set of operational standards. In addition, better coordination would allow humanitarian organisations to improve emergency responses.¹⁷⁴

Furthermore, improved linkages between the development and relief spheres will pave the way for strengthened efforts in prevention of acute malnutrition. These linkages are also needed at a time when there is growing policy and practice discussions on the potential for health systems to scale up different models of treatment including mass treatment.

Moving towards action

There is broad agreement that the recent Lancet Nutrition Series brings an important new body of evidence for the benefit of a set of specific nutrition interventions that together, in addition to other poverty reduction efforts, can help to accelerate the reduction of maternal and child undernutrition and in doing so contribute to achieving the MDGs.

The evidence base and the science for improving nutrition outcomes through such interventions are now relatively well established; yet very few countries are implementing them at scale. Achieving progress is not just about finding new technological solutions, but also about taking to scale the known multi-sectoral solutions through creative delivery mechanisms. *We know a lot about “what to do” about nutrition, but we need to focus much more on the delivery science of “how to do it at scale”.*¹⁷⁵

Large-scale effectiveness evaluations that can expand the evidence base for strategies and tactics to achieve high, sustained and equitable coverage with proven interventions to address undernutrition are lacking (though there are a few exceptions¹⁷⁶). There is a shortage of rigorous and policy relevant impact evaluation studies providing evidence on the scope, cost, scalability and impact of varied direct and especially indirect interventions.

Furthermore, although access to food, caring practices, health infrastructures and the environment are considered as the underlying causes of nutrition, very few studies have investigated the relative importance of these factors in both the short term and the long term. Decisions about what actions should be prioritised to address undernutrition are made difficult by the complex and inter-related causes

¹⁷⁴ ID21 Insights 73, 2008, Improving the nutrition status of children and women, IDS.

¹⁷⁵ Garret, J, 2008, Improving results for nutrition: A commentary on an agenda and the need for implementation research. The Journal of Nutrition. 138: 646-650.

¹⁷⁶ 30 impact evaluations relating to nutrition are available in the World Bank's Poverty Impact Evaluations Database. At the time of going to print there were 9 impact evaluations relating to nutrition. J-Pal is conducting research into the impact of the provision of quality water in preventing diarrhoea and by consequence nutrition. J-PAL is also looking how the improved status of girls in the household affects nutritional outcomes.

at stake. There is also a need to distinguish between acute and chronic forms of inadequate nutrition, and their different impacts e.g. stunting is irreversible after the age of two years and must be prevented, but wasting can be remedied by treatment that could lead to weight gain in a matter of weeks.

Most importantly, there is a pressing need to look at the social, economic, and political institutions that mediate access to and control over resources, choices and benefits. *Interventions that address a single contributing factor such as food availability or simply technical solutions, without considering the broader context are less likely to show sustainable gains in reducing undernutrition.*¹⁷⁷ This requires documentation and understanding of the impacts of policy processes under different political and social conditions.

¹⁷⁷ Johnson-Welch et al, 2005, op cit.

The Response

Undernutrition is not simply a technical conundrum waiting to be solved. Whilst complex, it is in large part also a governance failure at international, national and sub-national levels.

The international community lacks leadership, co-ordination and coherence, and spends too little.

The international nutrition community is technically and institutionally fragmented. A review by the Centre for Global Development concludes that over many years of activity, *“the funding, technical, executing and opinion-shaping institutions that make up the global nutrition sector have not coalesced into the same policy, funding and implementation community that exists for some other major global health priorities, such as immunization or tuberculosis.”*¹⁷⁸

Despite the large number of actors in the international nutrition community, the remit of nutrition tends to be narrowly defined. From an organizational perspective, no clear leader – with adequate resources and a clear mandate – emerges in the international community. Despite a couple of noticeable exceptions, the private sector and civil society are also poorly integrated in this community.

To date, technical developments in the international nutrition field – both in defining and measuring the prevalence of particular nutrition-related conditions, and in identifying promising “solutions” – have been driven by relatively small scientific, implementation and advocacy communities. They have focused on specific health problems, such as deficiency in particular micronutrients, or key interventions such as breastfeeding promotion, or advocacy targets such as combating the marketing of breastmilk substitutes in low-income countries. These communities have evolved their own conceptual frameworks, standards of evidence, and professional hierarchies, and have tended to interact relatively little – and often in a competitive mode, given limited funding – with other technical communities.

The nutrition community has therefore struggled to come up with cohesive messages that show a unified voice in the field. This implies major challenges in communicating a full picture of the nutrition problem and the many dimensions of its solution. Nutrition is broad and linked to culture, intergenerational issues and consumption patterns, and is thus seen as more amorphous an issue than specific disease areas; it cannot be tied to a single intervention or biological nexus.

¹⁷⁸ Levine, R and Kuczynski, D, 2009, Global Nutrition Institutions: Is There an Appetite for Change?, Centre for Global Development.

It is clear that despite the seriousness of the problems associated with maternal and child undernutrition, *the amount of nutrition-related aid provided to the 20 countries with 80% of globally stunted children is a small sliver of the total aid provided to these nations*. Total investments in basic nutrition services are 5 times less than those in food aid and 19 times less than donor assistance for HIV/AIDS. Basic nutrition investments by donors in low- and middle-income countries have been less than \$250-300 million per year between 2000 and 2005.¹⁷⁹ As oil and food prices put increased pressure on the fiscal position of many developing countries, in already resource-constrained scenarios, there will be increasing pressure to redress this imbalance given the magnitude and long term nature of the effects.

Nutrition can only be described as a political, administrative and institutional orphan.

Nutrition is a non-exclusive investment opportunity: many sectors can invest in improving it. However, nutrition is often located within one line ministry. *In the absence of strong incentives to develop cross-ministerial policies and programs for food and nutrition security, sector-specific homes for nutrition will end up favouring one pillar of good nutrition at the expense of the others*. The many sectors and bodies involved in tackling undernutrition require complex institutional arrangements and strong coordination mechanisms.

Nutrition specialists tend to work in Ministries of Health, where malnutrition is often viewed as a disease and treatable using biomedical interventions such as vitamin capsules. Institutions operate in a vertical fashion, denying agriculturalists and nutritionists opportunities to collaborate. Funding streams follow the same vertical pattern. Consequently, each sector is reluctant to use its scarce resources for activities that might seem to be another's responsibility.¹⁸⁰

This tendency to "departmentalise" nutrition is reinforced by the structures of external funding agencies, and by training programs in schools, universities and vocational settings.¹⁸¹ A mono-disciplinary approach is fixed in place by conceptual frameworks that equate food production with food security or equate nutrition with food security, sanitation, or behaviour change rather than emphasizing the interaction of a complex set of causes.

Over the past decade, donor-funded policies and programs designed to address undernutrition in the Global South have shifted away from agriculture-based

¹⁷⁹ Lancet, 2008.

¹⁸⁰ AAC/SCN, 2002, op cit.

¹⁸¹ Ibid.

strategies toward nutrient supplementation and food fortification programs.¹⁸² The nutrition field generally gives less weight to contextual factors such as gender inequality.

Lack of political commitment, capacity and data are severe constraints to action.

A high prevalence of undernutrition in a population is generally not seen as anomalous and indicative of a government's inability to fulfil its duties to its citizens. There is often little concern that the issue is critical to the future of the country, to the continued political success of government or to the well-being of its citizens. In consequence, there is *low political demand for action against undernutrition, and most governments do little to ensure that nutrition related goods and services are provided to their citizens.*

In a study by IFPRI covering four Sub-Saharan African countries (2008), political leaders and policymakers had only limited understanding of the determinants of nutritional status and the costs of aggregate undernutrition for national development. There needs to be a greater understanding of the process whereby political commitment to improving nutrition is generated. There is also a need, as a foundation for political dialogue, to raise the general public's awareness of the burden that undernutrition imposes on their well-being and what can be done effectively to reduce this burden.¹⁸³

Other constraints relate to data and capacity. The inadequacy of the information for decision making stems from several problems. Poor quality data, analysis and interpretation are often reported. There is often a lack of capacity to perform these tasks. Estimates can be poor. Interpretation of nutrition indicators is also frequently hampered by a lack of contextual information. In addition, the information base could be greatly enhanced by a stronger analysis of the causes of malnutrition and their relative importance.¹⁸⁴

Capacity constraints are particularly severe and the rationale for an enhanced focus on capacity is particularly relevant to nutrition, because malnutrition is multi-causal and its solutions multi-sectoral.¹⁸⁵ Establishing programmes of work without consideration of the capacity within country to deliver and sustain those activities will be ineffective in the medium to longer term. Capacity is about enabling competence in the workforce to do the jobs required to translate evidence into effective programmes on the ground.

¹⁸² IFPRI, 2008, High food prices: The what, who, and how of proposed policy actions.

¹⁸³ Benson, T, 2008, Improving nutrition as a development priority: addressing undernutrition within national policy processes in sub-saharan Africa, IFPRI.

¹⁸⁴ EC, 2008, Enhancing EC's contribution to address child and maternal undernutrition and its causes, Background paper for EC seminar.

¹⁸⁵ <http://www.unscn.org/layout/modules/resources/files/Brief1-12EN.pdf>

Rapid improvements in nutritional status and prioritisation, however, can happen.

Overall, experience shows that malnutrition can be effectively addressed on a large scale, at reasonable cost, through appropriate programmes and strategies backed by sustained political support. Positive experiences have demonstrated that *leadership and strategic capacity are key ingredients for advancing the national nutrition agenda and action*. Furthermore, programme experience and research show that when interventions address the multiple causes of malnutrition, harmonise the way institutions provide services and work with communities, and attend to the resource needs of both men and women, nutritional well-being improves in a timely and sustainable manner.

In *Thailand*, global prevalence of underweight reduced from about 25% in 1986 to about 15% in 1995 (this is over 1.1 percentage points a year and more than double the 0.5 percentage point per year decline in underweight which has been found elsewhere due to general development and in the absence of a nutrition program).¹⁸⁶ The approach taken included (i) provision of basic primary health care, with an emphasis on nutrition, clean water and sanitation, essential drugs and immunisation, (ii) community involvement in administration, financing and decision taking through village committees and village health communicators and a large number of volunteers, and (iii) poverty alleviations measures such as employment schemes, development and agricultural development projects.¹⁸⁷

Underweight in children in *Brazil* has been reduced from 10% in 1999 to 2.4% in 2006¹⁸⁸. As documented by the SCN¹⁸⁹, these results were largely achieved through “several large scale government programmes and mechanisms such as the “Zero Hunger” strategy which ensures the right to adequate food; the National System of Food and Nutrition Security...which integrates policies and actions at all levels of government and civil society in partnership with private enterprises; the Organic Law of Food and Nutrition Security...through which the right to adequate food is enforced; the National Council on Food and Nutritional Security.. comprised of 18 Ministers of State and 36 representatives of civil society; the National Conferences on Food and Nutritional Security; the Bolsa Familia Program which targets poor families through cash transfers with health and education conditionalities; and, other health assistance and maternal and child nutrition strategies including the Family Health Strategy, the Food and Nutrition Surveillance System and distribution of micronutrients as part of basic health services”.

¹⁸⁶ Heaver H. et al., 2002, Thailand's national nutrition programme – Lessons in management and capacity development, World Bank.

¹⁸⁷ Ibid.

¹⁸⁸ Keynote speech by Professor Patrus Ananias, Minister of Social Development and Fight against Hunger of Brazil, in the Report of the Standing Committee on Nutrition at its Thirty-Fifth Session, Hanoi, March 2008.

¹⁸⁹ Ibid.

Important steps have been taken in Malawi. The Government of *Malawi* established a national Food Security and Nutrition Unit in the Office of President and Cabinet in 1987. This step contrasted with the lack of attention devoted to nutrition during the previous decades. The nutrition advocacy that preceded and accompanied the creation of this unit was instrumental in adding “nutrition” to the agenda and title of this unit, but larger political and contextual factors, including economic decline, created the window of opportunity for this to occur.¹⁹⁰

Broad and inclusive partnerships are required.

Empowering communities

While better nutrition empowers people, the process through which malnutrition is reduced can also empower communities. Unlike most other types of human capital investment interventions, most nutrition programs are community based. As communities develop the capacity to undertake assessment, analysis, and action for nutrition interventions, they can apply this capacity to other types of intervention. Community-based nutrition programming can also build trust and a shared set of values and norms.¹⁹¹

To be sustainable, community-based interventions must build on traditional beliefs and care-giving activities, and extend these to the nutritional needs of mothers and children. Furthermore, they must ensure groups within communities, historically excluded and marginalised, are able to participate and benefit from such interventions, with particular attention to enhancing and enabling their voice.

Strong public-private partnerships

It is also increasingly clear that well focused, strategic partnerships between the private and public sectors are important in delivering improved nutrition.

The interconnectedness of nutrition and the commercial sector is unquestioned. The food industry has the supply chains and market penetration that far exceeds that of the public health sector, and therefore could contribute tremendously to distribution of nutrition-related products. At the same time, the practices and products of food manufacturers and distributors are also part of the problem: the over-refinement of staple grains that destroys nutrients; the marketing of breastmilk substitutes in communities with poor water supplies and where breastfeeding confers vital immunologic benefits to infants; the production, distribution and marketing of products that contribute to obesity, hypertension and diabetes.

¹⁹⁰ Administrative Committee on Coordination Sub-Committee on Nutrition (ACC/SCN), 2002, Nutrition: A foundation for development, UN.

¹⁹¹ *ibid.*

Because of this duality, public sector institutions have difficulty establishing flexible, open working relationships with corporate partners, both in-country and at the global level.¹⁹²

An emerging area for potentially strong public-private partnerships is the production of RUTFs. These soft, crushable foods, which can be easily consumed by children from 6 months old, can contribute to the treatment of SAM. RUTFs have been highly effective at reaching and treating large numbers of children in their own homes in many African countries (including Ethiopia, Malawi, Niger, and the Democratic Republic of Congo) and increasingly in Asia (including Sri Lanka, Indonesia and Pakistan).

A successful example of public-private partnership has been that of salt iodisation. A shortage of iodine in a diet can cause cretinism, mental retardation and premature birth. These iodine deficiency disorders (IDD) can be eliminated by adding iodine to cooking salt. Partnerships between governments and the salt industry have been one of the key factors in eliminating IDD. In many countries, the salt industry has taken up the cost of adding iodine to salt as part of their business.¹⁹³

¹⁹² Levine and Kuczynski, 20089, op cit.

¹⁹³ Insights, 2008, op cit.

Conclusion

Much of contemporary thinking on development does not adequately recognize the crucial role and impact of nutrition for achieving the MDGs. Governments and development partners have been slow to recognize and prioritise its importance. A series of key messages could be highlighted from the preceding presentation of the evidence:

- Money-metric measures of poverty offer a one-dimensional perspective which understates the inter-connections among the different dimensions of human welfare, poverty and the MDGs.¹⁹⁴ More emphasis is needed on the off-track nutrition indicators of poverty (MDG1).
- Food security is a necessary but not sufficient condition for ensuring that all enjoy adequate nutrition. There is a need to take nutrition out of both the food security and bio-medical boxes into a broader development arena. A focus on nutritional security is a way to complement health and food security.
- Interventions should be focused on pregnancy through the first two years of life as this is when irreparable damage happens. Neglect of nutrition through this period undermines all development investments.
- Strengthened investments are needed in direct interventions to improve nutrition, in financing the scale up of evidence-based nutrition-relevant actions in the high-burden countries, and in using new delivery mechanisms.
- Yet, a careful balance between direct and indirect interventions should be maintained. This requires working to improve nutrition not only through the health sector but also through appropriate actions in agriculture, rural development, water supply and sanitation, social protection, education, gender and community-driven development. It requires a concerted effort to analyse and address the underlying and basic determinants of undernutrition in different contexts, related to poverty, gender and exclusion.
- Public sector organisation and institutional reform is needed for better inter-sectoral collaboration for cross cutting issues such as nutrition. More policy champions are needed, particularly senior political and bureaucratic decision-makers. Operational capacities for addressing malnutrition in high-burden countries urgently need strengthening.
- Strengthened or newly formed systems for monitoring the nutritional situation are required in order to promptly detect changes/trends and identify the groups most vulnerable. Data from nutrition surveillance systems have to be analysed in a multi sectoral forum and in conjunction with data coming from agricultural

¹⁹⁴ Sundaram, JK, 2005, The critical role of nutrition for reaching the MDGs, Statement by Assistant Secretary-General for Economic Development, UNDESA.

production, market prices, changes in consumption patterns, changes in care practices, and other impact resulting from major shocks such as the food price crisis.

- Nutrition policy narratives need to be linked to those of the master development framework for the country. The ambitions of these frameworks are unlikely to be attained if the constraints imposed by undernutrition are not removed. Integrating appropriately designed and balanced nutrition actions in country assistance strategies, sector-wide approaches in multiple sectors, and PRSPs.
- International organisations must work together to create consistent and prioritised guidance. This should be based on evidence from impact evaluations of past projects and programmes, and careful analysis of the implications for nutrition of major global changes, such as climate change and rising energy prices.
- All of the above should be linked to strong and credible monitoring and evaluation, so results can be documented and lessons learned from large scale programming, under different conditions.
- More research is needed on the 'delivery sciences', and the partnerships and institutional configurations that underpin them. The multi-sectoral dimensions of nutrition, and how impact on nutrition is achieved through multiple sectors, also need further research and evaluation.

Glossary

BCR	Benefit cost ratio
DALY	Disability Adjusted Life Year
DFID	Department for International Development
EC	European Commission
FAO	Food and Agriculture Organisation
GDP	Gross Domestic Product
HIV	Human Immunodeficiency Virus
IFPRI	International Food Policy Research Institute
MDG	Millenniums Development Goal
OECD	Organisation for Economic Cooperation and Development
ORS	Oral Rehydration Salts
PRSP	Poverty Reduction Strategy Paper
RUTF	Ready to Use Therapeutic Foods
SAM	Severe Acute Malnutrition [Undernutrition]
SCN	Standing Committee on Nutrition (UN)
UNICEF	United Nations Children’s Fund
WFP	World Food Programme

What is Development?

Why is the UK Government involved?

What is DFID?

International development is about helping people fight poverty.

This means people in rich and poor countries working together to settle conflicts, increase opportunities for trade, tackle climate change, improve people's health and their chance to get an education.

It means helping governments in developing countries put their own plans into action. It means agreeing debt relief, working with international institutions that co-ordinate support, and working with non-government organisations and charities to give communities a chance to find their own ways out of poverty.

Getting rid of poverty will make for a better world for everybody.

Nearly a billion people, one in 6 of the world's population, live in extreme poverty. This means they live on less than \$1 a day. Ten million children die before their fifth birthday, most of them from preventable diseases. More than 113 million children in developing countries do not go to school.

In a world of growing wealth, such levels of human suffering and wasted potential are not only morally wrong, they are also against our own interests.

We are closer to people in developing countries than ever before. We trade more and more with people in poor countries, and many of the problems which affect us – conflict, international crime, refugees, the trade in illegal drugs and the spread of diseases – are caused or made worse by poverty in developing countries.

In the last 10 years Britain has more than trebled its spending on aid to nearly £7 billion a year. We are now the fourth largest donor in the world.

DFID, the Department for International Development, is the part of the UK Government that manages Britain's aid to poor countries and works to get rid of extreme poverty.

We work towards achieving the Millennium Development Goals - a set of targets agreed by the United Nations to halve global poverty by 2015.

DFID works in partnership with governments, civil society, the private sector and others. It also works with multilateral institutions, including the World Bank, United Nations agencies and the European Commission.

DFID works directly in over 150 countries worldwide. Its headquarters are in London and East Kilbride, near Glasgow.

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