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An audit of human nutrition in the current and future programmes of the UK Department for International Development in Pakistan

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Contents

List of Abbreviations

BMI	Body mass index
BRAC	Bangladesh Rural Advancement Committee
CI	Confidence interval
CIAF	Composite Index of Anthropometric Failure
DFID	Department for International Development
DHS	Demographic and Health Surveys
DNA	Deoxyribonucleic acid
FAO	Food and Agriculture Organization
FATA	Federally Administered Tribal Areas
GHI	Global Hunger Index
HAZ	Height for age z score
HDRC	Human Development Resource Centre
HIV/AIDS	Human Immunodeficiency Virus/Acquired Immune Deficiency Syndrome
IDD	Iodine deficiency disorders
IPTp	Intermittent preventive treatment (for malaria) in pregnancy
IU	International unit
KP	Khyber Pakhtunkhwa
MDG	Millennium development goal
MIC/MICS	Multiple index cluster survey
MPH	Master's degree in Public Health
MUAC	Mid-upper arm circumference
NGO	Non-Governmental Organisation
NCHS	National Centre for Health Statistics
PKR	Pakistan rupee
RCT	Randomised controlled trial
RTUF	Ready-to-use therapeutic food
SD	Standard deviation
TBA	Traditional Birth Attendants
UNICEF	United Nations Children's Fund
USD	US dollar
WAZ	Weight for age z score
WHO	World Health Organization
WHZ	Weight for height z score

Summary

This report presents a nutrition audit for DFID Pakistan. Andrew Hall, nutrition consultant, visited Pakistan from 19 July to 5 August 2011. In summary, he was to:

- Assess and identify the contribution of DFID Pakistan to reducing undernutrition in Pakistan
- Asses the potential for scaling up DFID's existing programmes to contribute to reduction of undernutrition in Pakistan
- To assess the feasibility of integrating the design of new DFID programmes in Pakistan
- To identify appropriate nutrition indicators that can be integrated into existing programmes
- To build nutrition capacity for DIFD Pakistan teams, and to think through how to strengthen the nutritional aspect of existing programmes.

See appendix 3 for the full terms of reference

The report first provides a brief overview of the extent, causes and consequences of undernutrition. The report considers the few data on anthropometric status of women and children, the extent of micronutrient deficiencies and indicators of nutrition behaviour in Pakistan. This is followed by an overview of guiding principles of the two DFID nutrition strategy papers (2010, 2011), and how the strategies can be implemented in Pakistan. The report goes on to consider how DFID Pakistan programmes could contribute directly and indirectly to improving the nutritional status of the population. This includes a review of potential indirect, multisectoral interventions including cash transfers for women.

Recommendations are made on the likely indicators to be used to assess the effectiveness of programmes. Potential opportunities to incorporate nutrition interventions in current and future DFID programmes are suggested (using the UNICEF conceptual framework) and the purchase costs are estimated. The problems with measuring nutritional status and the difficulties of attributing impact of nutrition interventions are discussed.

Summary conclusions:
- Despite the few data on undernutrition in Pakistan, up to half the under-fives suffer from stunting, underweight or wasting
- Addressing undernutrition will require multisectoral approaches in addition to direct (health) interventions. Direct interventions have the potential to address one third of the problem
- Health interventions focusing on pregnancy, newborn and the under-fives should be delivered through existing health service provision; most interventions could be delivered at low cost
- Direct cash transfers to women does present an opportunity to improve food security in Pakistan, although review of the literature presents mixed results
- Direct and indirect nutrition interventions could be incorporated in existing and future DFID programmes; impact measurement and demonstrating attribution will present a major challenge
- DFID programmes supporting policy and governance could impact on the underlying causes of malnutrition if they influence economic opportunities and food production.
- DFID could consider establishing a cross-sectoral group to monitor undernutrition across its portfolio of support programmes

1. Introduction

Maternal and child undernutrition remain pervasive and damaging conditions in low-income and middle-income countries. Pakistan has one of the highest levels of undernutrition in the world; a quarter of children are born underweight, and 37% of all under-fives are underweight. Globally, almost one billion people face hunger[1], and another one billion do not get enough vitamins and minerals. Undernutrition encompasses stunting (the longer-term consequences of undernutrition), wasting, and deficiencies of essential vitamins and minerals (collectively referred to as micronutrients) "Hunger" a feeling of discomfort from not eating, also describes undernutrition, especially with reference to food insecurity, Undernutrition is an important determinant of maternal and child health (box below).

Box: The impact of maternal and child undernutrition.
Source: Lancet series on Maternal and child malnutrition, 2008….

- Maternal and child undernutrition is the underlying cause of 3·5 million deaths, 35% of the disease burden in children younger than 5 years and 11% of total global DALYs
- The number of global deaths and DALYs in children less than 5 years old attributed to stunting, severe wasting, and intrauterine growth restriction constitutes the largest percentage of any risk factor in this age group
- Suboptimum breastfeeding, especially non-exclusive breastfeeding in the first 6 months of life, results in 1·4 million deaths and 10% of disease burden in children younger than 5 years
- Maternal short stature and iron deficiency anaemia increase the risk of death of the mother at delivery, accounting for at least 20% of maternal mortality

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Undernutrition is a result of two main causes: a poor diet and disease. The diet may be poor because of a lack of energy or micronutrients. Both the quality and quantity of food consumed are important: if the body's needs for energy or protein are not met by the diet or if even one micronutrient is lacking, there will be consequences for human health and for the physical growth and mental development of children.

Disease affects nutrition in several ways. Disease reduces the appetite, so less food is eaten during illness. Diarrhoeal disease – caused by exposure to unsafe water supply and inadequate sanitation – leads to undernutrition due to inability to absorb nutrients adequately. Furthermore, those who are already experiencing undernutrition are more susceptible to, and less able to recover from, infectious diseases (principally due to a compromised immune system). This is particularly harmful to very young children as they expend nutrients more rapidly than adults because of their relatively higher metabolic rate, and they also have relatively smaller body reserves of energy and nutrients. This is why children under 5 years of age are a key indicator group of nutritional problems, and of national development: they lose weight quickly and their growth slows down. Under nourished children are at greater risk of dying due to disease than well nourished children. It has been estimated that almost 50% of the 10 million children who die each year before they reach age of 5 years would not have died had they not been undernourished.[2] This is a powerful reason for preventing undernutrition.

The link between a poor diet and disease is captured in the UNICEF conceptual framework of malnutrition. This model is shown in figure 1 and illustrates how the two immediate causes of undernutrition are linked: disease contributes to a

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[1] FAO, 2010, The State of Food Insecurity in the World. FAO Rome 2010.
[2] Black, R.E., S.S. Morris and J. Bryce (2003). Where and why are 10 million children dying every year? *Lancet*, **361** (9376): 2226.

deterioration in nutritional status while a poor nutritional status can increase susceptibility to disease so that a vicious cycle can develop.

Figure 1 also shows that the three main underlying causes of undernutrition are poor household food security, which depends on both the availability of food and people's ability to gain access to food when it is available; a lack of services to treat and prevent infectious diseases, which includes water and sanitation; and caring practices, a general term for the way that children are fed, looked after and nurtured, both physically and psychologically. Studies have shown that psycho-social stimulation of children while they are being fed can help to improve their growth and development.[3]

Addressing the multifactoral causes of undernutrition requires a two-pronged approach; the implementation of evidence-based nutritional interventions[4] (and table x, section 5.3), and multi-sectoral interventions. Direct nutritional interventions have the potential to address one third of stunting globally; addressing domestic food access, land access and reform, social inequality, gender disparities etc.,(involving multi-sectoral approaches including agriculture, environmental health, education, economic development, empowerment of women and cash transfers) could impact on two-thirds of stunting.

Figure 1. The UNICEF conceptual framework or model of malnutrition. This describes the main causal pathways by which malnutrition occurs and can be used as a tool to analyse how changes in causes could lead to improved nutrition.

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[3] Walker, S.P., S.M. Chang, C.A. Powell and S.M. Grantham-McGregor (2004). Psychosocial intervention improves the development of term low-birth-weight infants. *Journal of Nutrition*, **134** (6): 1417.
[4] Lancet 371; 9610. 417-410. 2 February 2008
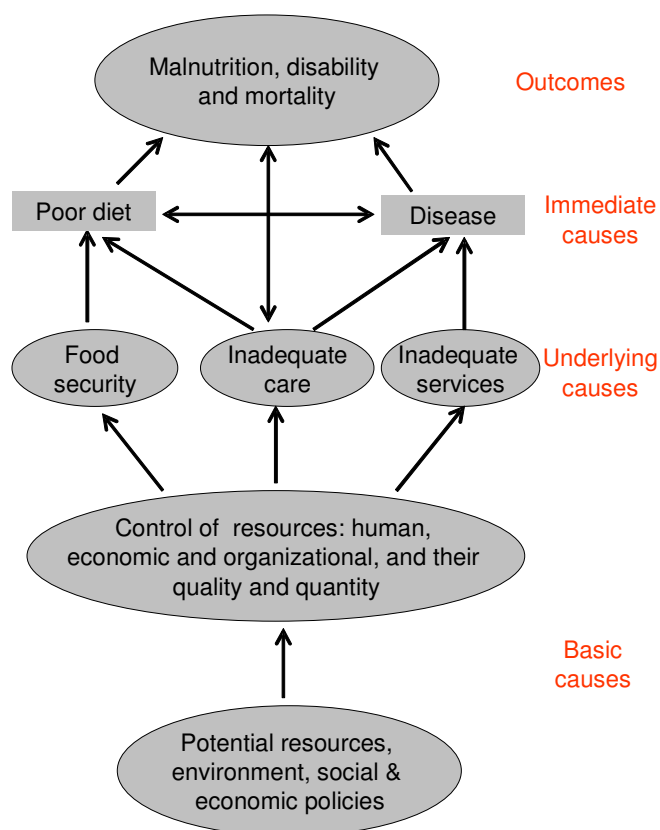
The twin problems of availability and access also apply to services, with the additional issue of quality. Good quality health services must be available and accessible to all members of society, without restriction because of cost or for social or cultural reasons. All people need access to clean water to drink and for their excrement to be disposed of safely.

The issue of caring practices is complex. Women – and in particular, women in traditional societies – are the principal carers for their children, and their lack of education contributes significantly to poor dietary practice. Even if they have the right knowledge, their ability to put this into practice is often hampered because they have little or no control over resources in a male-dominated society. Without control over resources, women will not be able to look after their children effectively. This will require significant societal change.

The conceptual model in figure 1 also illustrates that there are major basic factors that can contribute to malnutrition. They act on households, communities and societies in general and affect the quality and quantity of resources available and how they are controlled and used. These resources can be economic, organisational and human, and affect the various forms of capital that people can use to control their lives. The resources at people's disposal include the physical environment in which people live and how that can be controlled and used, and various forms of capital - social, human and economic, for example. These forms of capital are influenced considerably by government policies that facilitate people's access to resources as well as policies and programmes that protect the weakest and most vulnerable. The influence of cultural, religious and social systems is also important,

especially if it supports a bias against one group based on physical or social characteristics such as ethnic origin or sex.

The conceptual model shown in figure 1 can be used in three main ways in different circumstances:

- To analyse the likely causal pathways to malnutrition in a community or society;

- To identify gaps in services or programmes and therefore needs;

- To analyse how changes in policies, services or interventions could lead to improved nutrition.

What the conceptual model cannot do is quantify the relative importance of each of the underlying and immediate causes of undernutrition within any society as it is hard to weight the individual causes. Neither is it possible to use cross-sectional data to determine the relative contribution of each component to the type or degree of undernutrition. This is because nutritional status and its possible causes are usually measured at the same time, so it cannot be known which came first. For example, did disease cause undernutrition or did undernutrition predispose to disease, so that disease is a consequence rather than a cause? This illustrates that undernutrition is both an outcome of a causal pathway and a potential causal factor itself.

Cross-sectional data also do not capture the typical seasonality of undernutrition and disease, both of which are greatly affected by the environment. For example, rain is required for crops to grow but water also transmits diseases, so the rainy season is associated with verdure and diarrhoeal diseases. Somewhat paradoxically the period just before the harvest is often associated with a lack of food, called the 'hungry season', because the food stores of poor people have been used up and they are waiting for the next crop to be harvested.

To understand how children become undernourished it is necessary to collect data over time - longitudinally - on diet, disease and caring practices to try to identify causal pathways. Even then, when more than one factor is contributory, quantifying the relative effects of each factor is impossible for each individual and can only be done for data on large groups. This is done by assessing statistically how the variability in each nutritional outcome measure is related to the variation in a possible causal factor, usually called an exposure, such as a poor diet or disease.

The final factor that complicates the analysis of causes of undernutrition is that many effects are not immediately visible or take time to develop. Micronutrient malnutrition is often called a 'hidden hunger' because only when the deficiency is severe do the signs become apparent, such as an enlarged thyroid gland due an iodine deficiency (see Box 1). The same invisibility is true for stunted growth: it is necessary to know a child's age to be able assess whether the child is small or not. The hidden nature of much undernutrition also means that it can be difficult to make parents aware of it and understand it as a problem. If all the children of the same age in the village are small, then stunted growth may not be perceived as a problem, and it may not be a priority for action in any community-led needs assessment. Chronic undernutrition also takes time to develop so that the steady slide in a child's growth rate may not be recognised.

2. Malnutrition in Pakistan

Interpretation of the data from the nutritional surveys conducted in Pakistan is challenging.

Demographic and Health Surveys (DHS) were carried out in 1990-01 and 2006-07, a gap[of 15 years (they are carried out every 5 years in the majority of countries). The 2006-7 DHS did not take anthropometric measurements of children so could not report the prevalence of stunting, wasting or underweight.

Two further surveys have taken place: a national nutrition survey conducted 2001-2 by the Pakistan Institute of Development[5] involving 10,600 households, and a 2011 UNICEF national survey (supported by DFID) involving 28,000 households.[6] Neither data can be used reliably in this report for three reasons:

- First, the sampling method used in the 2011 survey may have over-sampled the youngest children in the age range 0 – 5 years which would lead to over-estimates of the prevalence of indicators of undernutrition. This can be corrected; re-analysis will provide valuable data.

- Second, the 2011 survey included children whose households had been affected by flooding, which may have resulted in an over-estimate of the usual prevalence of undernutrition, especially wasting.

- Third, the two national surveys used different growth references (NCHS in 2001 and WHO in 2011) to classify children as stunted, underweight or wasted, so comparisons cannot be made until the 2001 survey data is revised using the new WHO growth references (WHO has developed a conversion tool). Ideally, a minimum of three data points are required to be able to detect a trend; hence meaningful interpretation may still prove difficult.

Cross sectional surveys have been conducted during and after the 2010 floods by many agencies, but they are not representative of the overall nutrition situation in Pakistan. The surveys were done to assess the situation during a disaster and assess people's needs because the floods badly affected household food security and contributed to the increased transmission of disease. The increased prevalence of wasting found by the surveys is unsurprising..

Multiple Cluster Index Surveys (MICS) have been undertaken in three provinces, supported by UNICEF: in FATA in 2007;[7] in the Punjab in 2007-08;[8] and in Khyber Pakhtunkhwa (KP) in 2008[9] (which did not estimate the prevalence of underweight). The MICS in the Punjab probably represents the best recent data from rural Pakistan because the province contains about 55% of the population. The large sample size

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[5] Government of Punjab (2009). *Multiple Index Cluster Survey (MICS) Punjab 2007-08*. Punjab: Planning and Development Department, Bureau of Statistics, Government of Punjab, pp 243.
[6] Bhutta, A.Z. (2011). *National Nutrition Survey 2011. A brief report.* Karachi: Aga Khan University.
[7] Planning and Development Department (2009). *FATA Multiple Index Cluster Survey.* Peshawar: Planning and Development Department, Government of Pakistan pp 136.
[8] Government of Punjab (2009). *Multiple Index Cluster Survey (MICS) Punjab 2007-08*. Punjab: Planning and Development Department, Bureau of Statistics, Government of Punjab, pp 243.
[9] Planning and Development Department (2009). *NWFP Multiple Indicator Cluster Survey 2008*. Pesharwar: Planning and Development Department.

(around 57,400 households) allows the data to be broken down into sub-groups for meaningful analysis.

2.1   Anthropometric status

Annex x describes how nutritional status, including anthropometric status, is assessed. The main indicators are height-for-age or stunting, weight-for-height or wasting, and weight-for-age or underweight.

Table 1 shows estimates of the prevalence of indices of anthropometric failure from the 2011 UNICEF/DFID survey described above. The data are for Pakistan, and disaggregated by province, and show the   number of children aged 0-59 months affected, based on an estimated population of 23.1 million children in 2011.[a] . The data may be inaccurate, for the reasons described above. It is important to report data on the numbers of children affected as well as the prevalence of undernutrition. This is because even if the prevalence is shown to fall, the absolute number of undernourished children in Pakistan could remain the same or even increase as a result of population growth. When the possible bias for over-sampling has been corrected, the revised results have the potential to be used as a powerful advocacy tool for DFID to raise awareness of the situation in Pakistan, and to seek commitment from development partners, government and civil society.
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Table 1. The prevalence of anthropometric failure and the composite index of anthropometric failure (CIAF[10]) and numbers of children affected estimated from the 2011 UNICEF/DFID survey[11] of children aged 0 – 59 months in 5 major Provinces of Pakistan

	Stunted		Underweight		Wasted		CIAF	
	%	Millions	%	Millions	%	Millions	%	Millions
Punjab	37.3	4.8	26.2	3.4	13.1	1.7	48.2	6.2
Sindh	45.9	2.3	28.3	1.4	19.8	1.0	55.3	2.8
KP	39.3	1.4	25.9	0.9	17.1	0.6	50.5	1.8
Balochistan	53.6	0.9	37.0	0.6	16.1	0.3	60.3	1.0
Pakistan	40.6	9.4	27.4	6.3	15.4	3.6	51.0	11.8
Punjab 2007-08[b]	42.4	5.5	33.6	4.3	13.4	1.7	53.7	6.9

[a] This number is based on the distribution of children reported in the 2007 National Census and the current population estimated by the Population Reference Board.
[b] Prevalences from the MICS in Punjab in 2007-08[12] are also given and applied to the estimated population in 2011.

Figure 2 shows the percentage of children who are stunted, underweight or wasted by quintiles of wealth and by five levels of education achieved by the mother. There are clear associations between stunting and underweight and both household wealth and mothers' education:

- The prevalence of stunting is 24% lower in the highest quintile of wealth than in the lowest quintile, and 21% lower in the women with most education than those with no education;

- The prevalence of underweight is 20% lower in the highest quintile of wealth than in the lowest, and 18% lower in the women with most education than with no education.

The prevalence of wasting, 13.4% on average (95% CI 13.0, 13.8) with 5.6% severely wasted, shows no association with either household wealth or with the education of mothers (figure 2). The prevalence is about the same in both the wealthiest households and in households with the most highly educated mothers, and is no different from the poorest households or households containing mothers with no education at all. This prevalence is only 1.6% lower than the threshold applied by the WHO to describe a severe public health problem.[13] A threshold of 15% is currently being used by United Nations agencies in Pakistan as a rationale for supplementary feeding programmes, so the prevalence of wasting in Punjab was at least borderline before the disastrous floods and it is not associated with poverty or a lack of education.

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[10] CIAF involves a composite analysis of height for weight, height for age, and weight for age
[11] Bhutta, A.Z. (2011). *National Nutrition Survey 2011. A brief report.* Karachi: Aga Khan University.
[12] Government of Punjab (2009). *Multiple Index Cluster Survey (MICS) Punjab 2007-08.* Punjab: Planning and Development Department, Bureau of Statistics, Government of Punjab, pp 243.
[13] World Health Organization (1995). *Physical status: the use and interpretation of anthropometry. WHO Technical Report Series No 854.* Geneva: World Health Organization.

However, the lack of association between wasting and socio-economic status has been described elsewhere[14], and may relate to other factors, such as epidemics, or cross-cutting behaviours, egg, rapid weaning. Interestingly in the same paper15 the data given for Pakistan show inequality, estimated by the concentration index: negative values indicate that wasting is more concentrated in the poorest households. The value for Pakistan of was as low as for any other country. This is not consistent with the data for the Punjab, however.   In Pakistan there may be unmeasured factors that act on children or their mothers in all households, irrespective of wealth or education. As wasting is an acute form of undernutrition caused by a recent lack of nutritious food or by infectious disease, the care that children are given may be a factor. It would be useful to have an indicator that captured Pakistani women's ability to control the diet, food intake and health of young children or to see if there are poor practices that are in common with all mothers, independent of their wealth or education. Whatever the cause, the relatively high prevalence of wasting is of concern and data are needed to try to explain it.

Figure 2. Data on the prevalence of stunting, underweight and wasting reported in the 2007-08 MIC survey in Punjab[15] by quintiles of wealth on the left and by the education level achieved by the mothers of children in each household on the right. The sample size was 57,386 children.

Stunting by wealth quintiles

Stunting by education categories

Underweight by wealth quintiles

Underweight by education categories
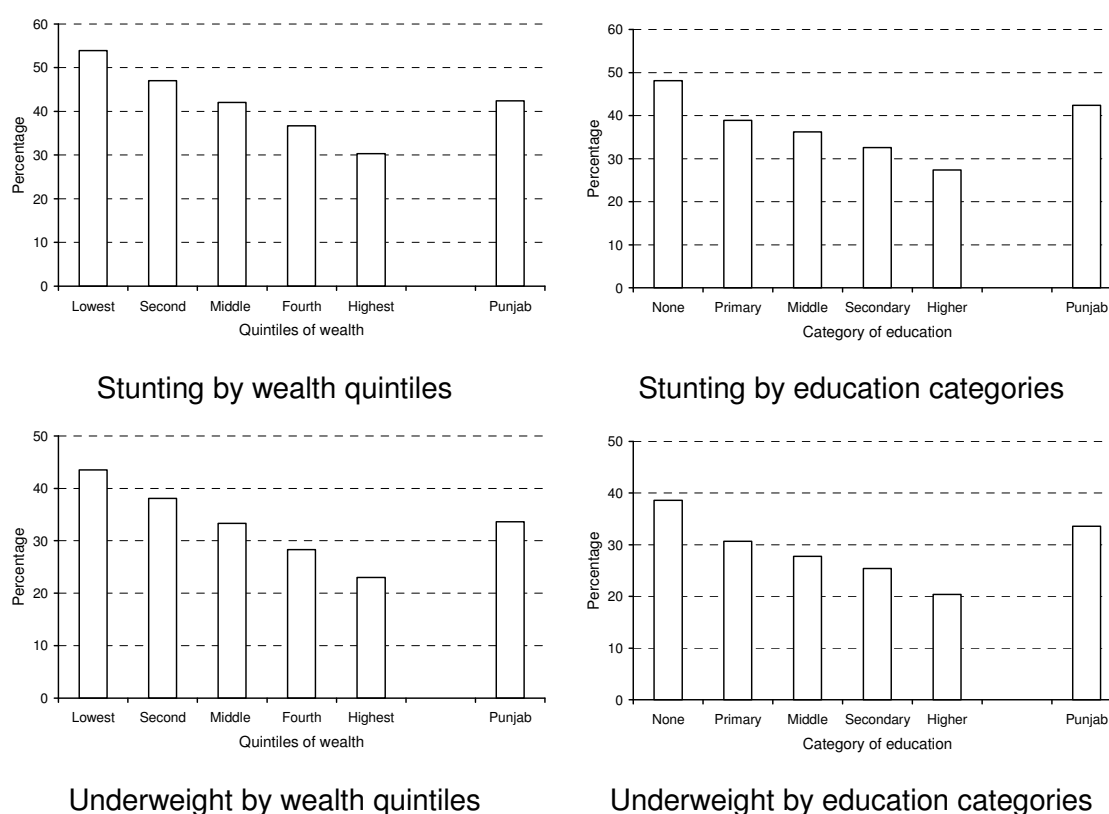
[14] Van de Poel, E., A.R. Hosseinpoor, N. Speybroeck, T. Van Ourti and J. Vega (2008). Socioeconomic inequality in malnutrition in developing countries. *Bulletin of the World Health Organization*, **86** (4): 282-291.

[15] Government of Punjab (2009). *Multiple Index Cluster Survey (MICS) Punjab 2007-08*. Punjab: Planning and Development Department, Bureau of Statistics, Government of Punjab, pp 243.
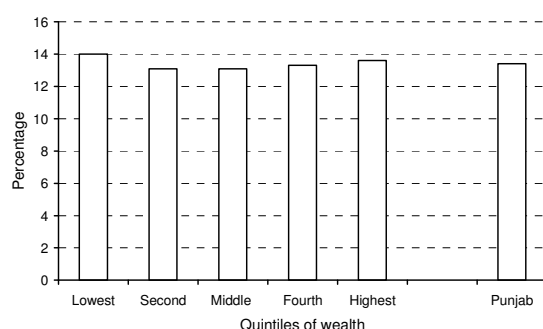
Wasting by wealth quintiles
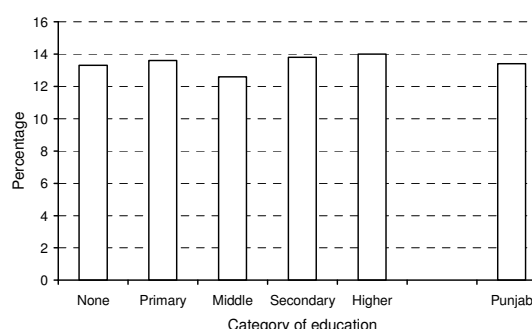
Wasting by education quintiles

It will be interesting to see if similar trends are seen in the data collected in the recent DFID/UNICEF survey, if they can be disaggregated by indicators of household wealth and mothers' education and by province, to see if the relationship occurs elsewhere in Pakistan. Perhaps more importantly, the analysis could focus on the proportions of severely wasted children only by wealth and education, as under normal circumstances they would be admitted to a therapeutic feeding programme. If the same trends are confirmed then it raises the issue of how to identify and treat severely wasted children in the households of seemingly relatively wealthy and well-educated women.

The data shows clear evidence of stunted growth and underweight, probably due to a lack of energy and micronutrients and the consequences of repeated infectious diseases. More information is needed on causes of malnutrition among children in Pakistan in all rural wealth groups to try to understand the effect of caring practices.

2.2   Micronutrient deficiencies in Pakistan

The prevalence of micronutrient deficiencies in Pakistan is high;

Data from the 2011 UNICEF/DFID survey showed:

Children under 5 years:

- 63% had a low haemoglobin concentration and were classified as anaemic (n=8,523)
- 47% had a low serum ferritin concentration, evidence of iron deficiency (n=1,696);
- 45% had a low vitamin A concentration (n=2,531)
- and 38% had a low serum zinc concentration (n=2,933).

Pregnant women:

- 54% had a low haemoglobin concentration and were classified as anaemic (n=8,612);
- 21% had a low serum retinol (vitamin A) concentration (n=3.055);
- 28% had a low serum ferritin concentration (n=1,416);
- 48% had a low serum zinc concentration (n=2,949);

Two small surveys of iodine deficiency:

- A low urinary iodine concentration was found in 39% of a small sample of school-age children (n=385)

- A prevalence of 66% in a sample of 269 children in Battagram District of KP in 2006.[16]
- 54% of pregnant women had a low urinary iodine concentration (n=385) in . Battagram District of KP in 2006.[17]

The conclusion is that micronutrient deficiencies are common of which an iodine deficiency is perhaps of greatest concern because of its profound effects on mental development.

2.3   Indicators of household nutrition behaviour

Only a selection of indicators is presented here as a review of the determinants of malnutrition in Pakistan was not requested and the operational plan stated that DFID would not invest directly in water and sanitation.

The data available for review were also limited : a DHS in 2006 which did not measure anthropometric status; a MICS in KP which also did not measure anthropometric status; and MICS in FATA and the Punjab which did make anthropometric measurements. A search of the PubMed database on the terms 'Pakistan' and 'underweight', both of which are subject headings on which papers are indexed, produced 30 research papers of which 20 were relevant to nutritional status over the last 20 years. This number compares with 71 papers with the same subject heading for Bangladesh and 232 for India.

One study in Pakistan found that consanguinity was a risk factor for underweight, but a lack of breastfeeding was a greater risk.[18] A useful study looked at spatial clustering of psychomotor development and malnutrition in urban and rural Sindh, where 18% of children were found to be wasted.[19] Another study looked at social stratification and development, including nutrition.[20] There were also two papers about obesity among urban school children[21],[22] and one on eating disorders,[23] perhaps reflecting the nutritional concerns of the urban elite.

The most useful data identified were from a MIC survey in the Punjab in 2007-08 which reported that only 6% of households were using adequately iodised salt; 79% of children had recently been given a capsule of vitamin A; and only 49% of children

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[16] Hall, A. and H. Kirby (2010). The numbers, educational status and health of enrolled and non-enrolled school-age children in the Allai Valley, Northwest Frontier Province, Pakistan. *Social Science and Medicine*, **70** (8): 1131-1140.

[17] Hall, A. and H. Kirby (2010). The numbers, educational status and health of enrolled and non-enrolled school-age children in the Allai Valley, Northwest Frontier Province, Pakistan. *Social Science and Medicine*, **70** (8): 1131-1140.

[18] Hasnain, S.F. and S.K. Hashmi (2009). Consanguinity among the risk factors for underweight in children under five: a study from rural Sindh. *J Ayub Med Coll Abbottabad*, **21** (3): 111-116.

[19] Avan, B.I. and B. Kirkwood (2010). Role of neighbourhoods in child growth and development: does 'place' matter? *Social Science and Medicine*, **71** (1): 102-109.

[20] Hadden, W.C., G. Pappas and A.Q. Khan (2003). Social stratification, development and health in Pakistan: an empirical exploration of relationships in population-based national health examination survey data. *Social Science and Medicine*, **57** (10): 1863-1874.

[21] Jafar, T.H., Z. Qadri, M. Islam, J. Hatcher, Z.A. Bhutta *et al.* (2008). Rise in childhood obesity with persistently high rates of undernutrition among urban school-aged Indo-Asian children. *Archives of Disease in Childhood*, **93** (5): 373-378.

[22] Warraich, H.J., F. Javed, M. Faraz-Ul-Haq, F.B. Khawaja and S. Saleem (2009). Prevalence of obesity in school-going children of Karachi. *PLoS ONE*, **4** (3): e4816.

[23] Suhail, K. and N. Zaib u (2002). Prevalence of eating disorders in Pakistan: relationship with depression and body shape. *Eat Weight Disord*, **7** (2): 131-138.

were exclusively breastfed.[24] The same percentages reported in a MIC survey in KP in 2008 were 13% using iodised salt, 63% getting vitamin A and 45% exclusively breastfed.[25]

The high prevalence of iodine deficiency is likely to be due largely to the poor uptake of iodised salt. Salt is being iodised by a small proportion of factories with help from the Micronutrient Initiative, but naturally occurring rock salt is widely used. A small survey in KP a year after all households had been given iodised salt in food rations after the earthquake found that 15% of children had excess iodine in their urine indicating that iodised salt was being consumed but 66% had low values, indicating that it wasn't. This small survey suggests that health education to use iodised salt is needed. Supplements may be required until social marketing can be brought to bear.

3. DFID's nutrition strategy

DFID's 2010 nutrition strategy "The neglected crisis of undernutrition" [26] made a cogent argument for preventing and treating undernutrition. In September 2011 DFID published a second paper "Scaling Up Nutrition: the UK's position paper on undernutrition" [27]. In this, DFID has committed to scaling up both nutrition-specific interventions (with the potential to reduce stunting by one third globally), and nutrition sensitive development. Nutrition sensitive development will involve adjusting and redesigning programmes across the sectors, including agriculture, environmental health, education and cash transfer programmes. In the context of analysing how current programmes in Pakistan may affect nutrition and what additionally could be done, it is useful to extract and summarise the Guiding Principles of the strategy.

3.1   Guiding principles of nutrition strategy

Focus on countries with a high burden of undernutrition. Although Pakistan is in the second rank in terms of prevalence it may contain as many, if not more, undernourished children than any country in Africa.

Focus on the poor and excluded. In Pakistan this includes groups such as the landless rural poor, day labourers in urban slums, minority ethnic groups and people of low social caste. Such people may be poorly educated, have poor access to services, may be disenfranchised, and may lead a subsistence style of life. Reaching them can be hard.

Focus on women's power and agency. This is likely to be central to improving children's nutritional status in Pakistan because traditional and religious strictures on women and their lack of protection from intimidation and violence is very likely to have a substantial influence on their ability to care for themselves and for their children.

Prioritise women and children from conception to 2 y "The first 1000 days". This recognises the crucial role of nutrition in children's physical and mental development but should not assume (as many do) that older children will not benefit from better

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[24] Government of Punjab (2009). Multiple Index Cluster Survey (MICS) Punjab 2007-08. Punjab: Planning and Development Department, Bureau of Statistics, Government of Punjab, pp 243.
[25] Planning and Development Department (2009). *NWFP Multiple Indicator Cluster Survey 2008*. Pesharwar: Planning and Development Department.
[26] DFID (2010). *The neglected crisis of undernutrition: DFID's strategy*. London: Department for International Development, pp 43.
[27] Scaling Up Nutrition; the UK's position paper on undernutrition. London: Department for International Development. September 2011

nutrition, especially during the school-age years. There is evidence that the prevalence of stunting and low BMI-for-age increases with age among school-age children,[28][29] including data from Pakistan.[30]

Tackle both acute and chronic undernutrition. This recognises the fact that undernutrition is a consequence of both short term and long term causes. Both acute and chronic undernutrition occur in Pakistan.

Respond through multiple sectors. The recognition that addressing around two-thirds of global stunting will not respond to nutrition-specific interventions alone, but require a multi-sectoral approach, to include agriculture, environmental health, education and cash transfers

Increase effectiveness of programmes in food, health, water, sanitation and social protection. This requires comparative data to show in each context that one approach is more effective than another, which is hard to do. The usual approach is to identify which of these essential services is missing or deficient and assume that providing the service will have a beneficial effect. DFID in Pakistan has judged that clean water and sanitation, HIV/AIDS and malaria control are not strategic priorities for intervention. It might be better to state this guiding principle as an intent: to deliver effective programmes in communities in which these services and programmes were lacking.

Bridge the gap between humanitarian and long term development. The lack of a bridge, particularly in funding, has been a major issue with development agencies for many years as sustained action to reduce the prevalence of undernutrition can help to protect people from future shocks. As large, densely populated areas of Pakistan are recovering from a recent natural disaster, this is a good opportunity to learn how to bridge that gap, from humanitarian relief and demands for supplementary food, to long term development to rebuild livelihoods and improve the quality of people's diets.

3.2   Indicators of effectiveness in nutrition

If current or future programmes are to have nutritional benefits, then indicators will be required to assess those benefits. A recent DFID document[31] (*Development of guidance for indicators for monitoring the impact of DFID's nutrition strategy*) and an accompanying spreadsheet specify three levels of nutritional indicators: compiled, core and optional. Compiled indicators are at the highest level and are presumably to be reported by DFID programmes in all countries and collectively:

1. The percentage of underweight children <5y old, which is a Millennium Development Goal indicator (MDG 1.8)
2. The global hunger index (GHI), which is a composite calculated from: the proportion of the population that is undernourished (data from FAO); the

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[28] Partnership for Child Development (1998). The anthropometric status of schoolchildren in five countries in the partnership for child development. *Proceedings of the Nutrition Society*, 57 (1): 149 - 158.

[29] Rousham, E.K. *et al.* (2011). Anthropometric status and prevalence of anaemia among school aged children and adolescents in 11 low-income countries. *American Journal of Clinical Nutrition* **94** (2): 571-7.

[30] Hall, A. and H. Kirby (2010). The numbers, educational status and health of enrolled and non-enrolled school-age children in the Allai Valley, Northwest Frontier Province, Pakistan. *Social Science and Medicine*, 70 (8): 1131-1140.

[31] DFID/HDRC (2010). *Development of guidance for indicators for monitoring the impact of DFID's nutrition strategy*. London: Department for International Development.

percentage of underweight children <5 y old (see 1); and the death rate among children <5 y. The first two components contribute to about 90% of the index.   Table 2 shows the most recent data for the main countries in South Asia.[32]

3. The number of children <5y whose nutritional status is improved by DFID programmes.

4. How much is spent on activities related to nutrition.

Table 2. The Global Hunger Index of the main countries in South Asia in 2010 calculated as the average of the three components.[33]

Country[a]	% under-nourished	% under-weight	Under 5 death rate %	Global hunger index
Bangladesh	26.0	41.3	5.4	24.2
India	22.0	43.5	6.9	24.1
Nepal	16.0	38.8	5.1	20.0
Pakistan	**23.0**	**25.3**	**8.9**	**19.1**
Sri Lanka	21.0	21.1	1.5	14.5

[a] Data were not available for Afghanistan.

Compiled indicators 1, 3 and 4 require data that are hard to collect. The proportion of children who are underweight requires data from recent surveys, which have been notably lacking in Pakistan to date, so DFID will need to put in place measures to collect data.

The number of children whose nutritional status is improved will be very difficult to estimate because it requires an untreated control group to be able to estimate the amount of change that is attributable to DFID programmes (see *Measuring nutritional status and attributable impact*, below). It would be better to recast this indicator to reflect coverage of DFID programmes, such as the number of mothers or children treated or participating in programmes, rather than state it in terms of an impact that is very hard to measure.

The amount spent will be hard to apportion for programmes that may have indirect effects on malnutrition or nutrition: by potential impact, by actual impact, by actual expenditure, by proportional expenditure? This requires the attention of an economist and raises the issue of double reporting: the sum of the amount spent on each apportioned outcome should not be more than the actual total spent. Such an analysis could lead to an increase in the amounts spent on nutrition because of indirect spending through other programmes, but this should reduce the total spent on other programmes so their scale may seem to be diminished.

In addition to the compiled indicators there are five core indicators:

1. The percentage of children <5y who are stunted,
2. The percentage of children <5y who are wasted, only in emergencies.

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[32] IFPRI, Concern and Welthungerhilfe (2010). *2010 Global Unger Index. Challenge of Hunger: focus on crisis of child undernutrition*. Bonn, Washington, DC & Dublin: IFPRI, Concern and Welthungerhilfe.
[33] IFPRI, Concern and Welthungerhilfe (2010). *2010 Global Unger Index. Challenge of Hunger: focus on crisis of child undernutrition*. Bonn, Washington, DC & Dublin: IFPRI, Concern and Welthungerhilfe.

3. The BMI of non-pregnant women age 15-49y, presumably expressed as the percentage with a value of <18.5 kg/m^2
4. The percentage of newborn who are <2.5 kg.
5. Examples of research having an impact.

Indicators 1, 3 and 4 require data to be collected regularly on a representative sample of Pakistani households. Indicator 2 is thought to be most relevant to emergencies but the data presented in Figure 2 suggest that the prevalence of wasting should be a core indicator for Pakistan in the long term, perhaps in the context of mothers empowered to care for their young children. There is a wide range of optional indicators including: low MUAC, infant feeding practices, micronutrient deficiencies, deworming, undernutrition of mothers, immunisation, dietary diversity, water and sanitation, hand-washing and indices of food consumption, hunger and assistance from social protection programmes. In Pakistan the focus should be on indicators of care for young children, such as complementary feeding practices and vaccination rates.

As there are no regular means to collect such data in Pakistan, there will need to be investment in systems and methods to collect data. There are already some data collection systems being put in place: a randomised controlled trial is being done in the Punjab to assess the impact of an economic opportunities programme; and a six-monthly survey system is being implemented in a sample of 1,000 households in each of the 36 districts of the Punjab to collect data for the next 3 years on enrolment in school. As most DFID programmes could usefully collect information on households, there seems to be potential to collect data periodically on a wide variety of indicators that could meet the needs of several programmes on coverage and even impact. This is discussed in more detail below.

4. Analysis of DFID Pakistan programmes' potential impact on nutrition

The UNICEF conceptual model described above has been applied here and was used during the visit by the consultant to Pakistan with all staff to analyse the causal pathways by which DFID programmes in Pakistan could influence nutritional status, by treating or preventing malnutrition. The model is simple and straight-forward to apply, so could be used in future by all DFID sector teams to analyse the potential causal pathway of programmes.

First, the level of causality needs to be assessed – immediate, underlying or basic. The terms in the boxes can be edited to reflect the activities that are expected to lead to an impact along the DFID results chain:

input → process → output → impact

It is less easy to do this sort of analysis in terms of log frames:

input → activities → output → goal

partly because nutritional effects should be seen as subsidiary or secondary rather than main and primary. There is a danger that, if nutritional outcomes were required of programmes that do not deal with the immediate causes of malnutrition, the effectiveness of the main goal could be diminished. It may be better for programmes that do not have specific nutritional purposes or goals to view potential nutritional effects as a beneficial consequence rather than as a prime objective or outcome unless there are clear means to put a nutrition component into a programme. It cannot be expected that non-nutritionists staff will know what to do or how to do it, so the new nutrition advisor may have to look at all programmes and identify opportunities. The risks and benefits will need to be assessed. The analysis presented here aims to show the broader and more far-reaching effects of existing interventions that are not immediately nutritional.

Second, the direction of the effect along the causal pathway in the UNICEF model is a matter of logic and judgement rather than being based on clear evidence.

Third, it is impossible to assess the strength of any effect that a programme might have on a single form of undernutrition if it acts on more than one causal pathway, through food or disease, unless the programme deals specifically with one of the immediate causes. If a programme that affects a basic cause of malnutrition could increase food intake, improve care and prevent disease, separating the effects of each factor on a single outcome such as the prevalence of underweight is very difficult and will require accurate indicators of the effectiveness or degree of implementation that could be used in a statistical analysis of the variance in any nutritional outcome measure. The issue of attribution of impact will be discussed in more detail below.

The main issues that have been identified that could affect the *basic causes* of malnutrition in Pakistan could be summarised as:

- Policies concerning food, especially staple crops; the environment (including access to water for irrigation, fertilisers, seed stocks etc); access to land and land tenure.

- Policies concerning the protection of women including the ability to enforce them and hold people accountable, not just in government but in households, where the agency of women perhaps most directly applies to nutrition.

- Lack of capital to generate income or grow food, including access to financial capital and collateral to obtain loans.

- Education and skills to improve crop quality and yields, to gain employment, and to gain knowledge of nutrition and child care (that can be put into practice).

- Lack of income to provide sufficient food through employment, pensions, remittances and stipends.

The main issues that have been identified that could affect the *underlying causes* of malnutrition in Pakistan could be summarised generically as:

- Poor household food security: availability and access to food; ability to grow or buy all energy, protein and micronutrients;

- Inadequate services: availability and access to good quality preventive and curative health services; access to clean water and sanitation;

- Inadequate care: knowledge of good food preparation practices; equitable distribution of food within the household that protects the most vulnerable.

How these factors apply in Pakistan requires more data.

All these factors can be aggravated by disasters and people's lack of resources and capital of various sorts that enables them to withstand repeated shocks.

The main issues that have been identified that could affect the *immediate causes* of malnutrition in Pakistan can be summarised as:

- Inadequate diet: energy, fat, protein and micronutrients;

- Infectious disease:

    - preventing infection through public health measures (access to clean water, immunisation, insecticide-treated nets, IPTp etc);
    - curative services ; treatment of diarrhoeal disease, reparatory infections, malaria

The main likely outcomes at the end of the causal pathway leading to better nutrition are:

- Improved growth and mental development, so children's physical or intellectual potential are more likely to be achieved;

- A lower risk of dying during early childhood;

- A lower risk of women dying during childbirth;

- A lower risk of chronic diseases in adulthood as a consequence of physiological adaptation to severe undernutrition during childhood.

4.1   Nutritional consequences of DFID programmes

DFID in Pakistan is working in four main sectors:

1. Programmes in governance and sub-governance are working to improve the management of resources, undertake provincial government reform, promote transparency and accountability in government, promote citizens' engagement in government, and institutionalise justice for women.
2. Programmes in economic development are providing skills and training for employment, providing skills to rear livestock, and providing cash transfers to poor women.
3. Programmes in education are aiming to increase the demand for education among parents; to increase the citizen's voice in education by increasing transparency and accountability; to develop public private partnerships to increase the number of schools; to increase enrolment in primary and lower secondary schools, especially by girls such as by offering stipends for girls who attend school for at least 80% of the time; and to improve the quality of learning.
4. Programmes in health are focussing on increasing access to health services for women and their young children through district and sub-district hospitals; by increasing the number of community midwives to ensure safe deliveries; and by improving the preventive and curative health services provided by lady health workers.

An analysis of the programmes of DFID in Pakistan suggests that improved nutrition could be an outcome of all four main programme sectors.

Programmes in governance and sub-governance could have effects at the level of basic causes of undernutrition by promoting:

- Policies to empower and protect women, especially in households, including a visible and effective mechanism for enforcement;

- Policies that promote the inclusion of women in society, including government and education;

- Policies to promote social stability and prevent conflict, which can disrupt food production or food supplies;

- Policies that lead to effective and accessible health and nutrition services.

At the level of basic causes, programmes in Economic growth could promote activities to:

- Improve skills and employability so that food security is achieved by households;

- Increase food production and generate income or goods for barter;

- Increase robustness to shocks by increasing household assets, which helps to prevent a slide into malnutrition, especially in a disaster.

Also at the level of basic causes, programmes in Education promote activities to:

- Enrol girls in school where they can be provided with health education to understand good nutrition for when they become mothers,

- Retain girls in school to delay marriage and first pregnancy, thereby reducing the risk of a low birth weight baby and of dying during childbirth;

At the level of underlying and immediate causes current programmes in Health promote activities to:

- Improve the delivery of basic health services to pregnant women through lady health workers, including information on breastfeeding and complementary feeding;

- Train community midwives to attend deliveries and reduce the risk of maternal and infant mortality.

4.2   Causal pathway analysis

The possible causal pathways by which DFID programmes could have an effect on preventing malnutrition are illustrated in Figure 3, A to F, which apply the UNICEF conceptual model.

In the Figures lines in red imply a causal effect; the thickness of the lines indicates a stronger effect; blue lines indicate effects by empowering women; and dotted lines indicate indirect effects on the next generation – today's children's children – usually for educational interventions.

A matrix of current programmes and their possible nutritional outcomes is shown in Appendix 2.

Figure 3, A to D. Possible causal pathways by which DFID programmes in Pakistan could have an effect on nutrition.
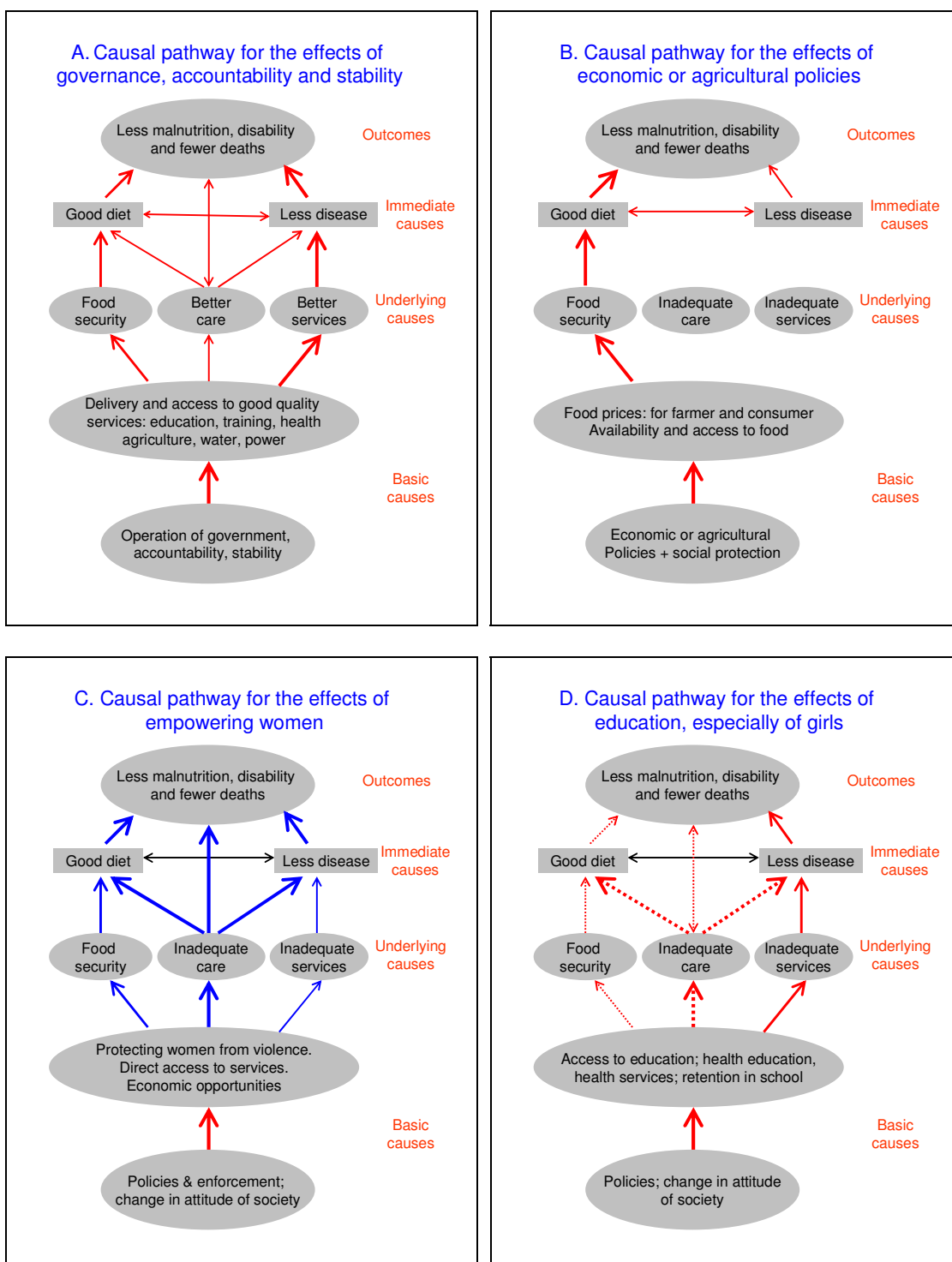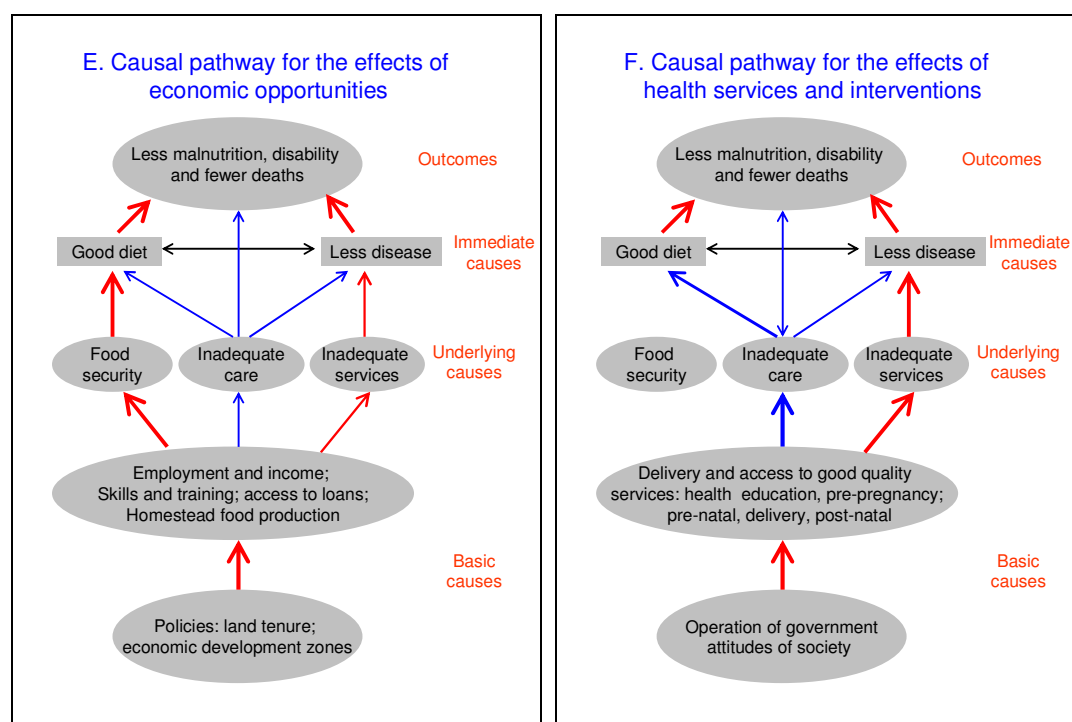
Figure 3, E and F. Possible causal pathways by which DFID programmes in Pakistan could have an effect on nutrition.

A few conclusions can be drawn from this analysis to address the first three objectives to this consultancy.

Objective 1. All current DFID programmes could have an impact on nutritional status, largely because they affect people's ability to care for themselves and their children, a major component of which is food security and protection from disease. However as their actions are distal to the outcome, as they could have their effects through three possible causal routes (food security, care and services, which includes water and sanitation as well as preventive and curative health services). As the outcomes are mostly non-specific indicators of nutrition such as the prevalence of underweight, it is extremely hard to quantify the extent to which DFID programmes will contribute to a reduction in undernutrition in Pakistan. For example, the impact of programmes in governance are mostly indirect, while programmes in economic growth and education are intermediate in their possible effects on nutritional status. In the health sector, DFID have few directly nutritional interventions at the moment, so the effects will be to increase access to health services so, in theory, preventing undernutrition and deaths. Only when an intervention affects diet or disease directly and the outcome is directly related to that intervention is it possible to measure a direct impact. For example, if iron supplements are given to women and their iron status improves then it could be judged that iron made the difference. But if a programme broadly affects household food security, measuring and attributing an impact even on a highly specific outcome such as iron status requires a control group to judge that the programme was responsible for the change not a concurrent, independent change. This is particularly so in fragile environments where food production and the transmission of disease depend on the seasons: a good harvest can have great impact on children's nutritional status, so this needs to be controlled for in any evaluation.

When the activity that makes the difference is a long way from the outcome on the causal pathway and when there are multiple programmes that could all have an effect, some of which are not DFID programmes, the effects of each programme cannot be separated. Indicators of nutritional status such as the prevalence of stunting, underweight, wasting and anaemia are to some degree composite indexes of national health and development and changes cannot easily be attributed to one programme alone.

Objective 2. For the same reasons it is not possible to say whether scaling up one programme will have more effect than another. If DFID wants to increase the nutritional impact of programmes then activities which directly affect the immediate causes of undernutrition (diet and disease) will have the most immediate and possibly measurable effects on nutritional status, and could be attributed to DFID programmes if a good evaluation design was applied. Some of the interventions listed by the Copenhagen Consensus (www.copenhangenconsensus.com) have been shown to be highly cost effective, such as micronutrient supplements and deworming. But as Section 5 will discuss, these do not get at the root causes of undernutrition and they are not sustainable. It is better in the long term to enable people to obtain micronutrients from their diet and to prevent worm infections by sanitation. But both giving micronutrients and deworming will have quick benefits to deficient and heavily parasitised children, so they need to be done, and can contribute immediately to child development. The conclusion is that programmes that treat the immediate causes of malnutrition will have the quickest, short-term effect, but programmes that tackle the basic and underlying causes will have the greatest long term effect and are likely to be sustainable. Both should be applied, especially if quick results are required.

There may be other constraints, even to long term programmes. It could be argued that until mothers in Pakistan are given full control over the diet and health care of their children, improving nutritional status will be slow and dependent on direct solutions delivered to the poorest people, such as supplementary food and micronutrients. Increasing household income will be important, but as Figure 1 indicates, how that income is then used to buy better food and buy healthcare is equally important, and women consistently make better decisions than men when household resources are limited. For example an analysis of annual data from a nutritional surveillance system in Bangladesh found that the 1,972 households that were headed by a female had significantly less income than the 51,871 households that were headed by a male, but that when women were in charge they spent more on medical care and food, their children were less likely to be stunted and the women themselves were less likely to be undernourished.[34] The challenge is to strike a balance between providing immediate and direct interventions to treat and prevent undernutrition that could have quick effects but need to be repeated regularly, but also to put in place interventions that tackle the underlying causes of malnutrition that will have long-term and sustainable effects, even if they are slow to act and hard to measure.

Objective 3. As the indicators of most nutritional outcomes are not specific and respond to multiple interventions or treatments, then it is not possible to identify indicators that could be used by specific programmes. Even a seemingly specific nutritional measure such as haemoglobin concentration is dependent on many nutritional factors including iron, vitamin A, vitamin C, folate and vitamin B12 . For this reason the main and most commonly used nutritional indicators, the prevalence

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[34] HKI (2001). *When the decision-maker is a woman: does it make a difference for the nutritional status of mothers and children?* Dhaka, Bangladesh: Helen Keller International, pp 4.

of stunting, wasting, underweight, and anaemia, are best viewed as general indicators of the effectiveness of all programmes. This will include the effects of programmes of other agencies if they are active in the same geographical area and will be influence by natural events such as climate and rainfall. The problems with measuring the effects attributable to programmes are discussed in Section 6.

5. Additions to DFID programmes that have nutritional outcomes

There are four main strategies to improve human nutritional status: diversify the diet, fortify foods, supplement the diet, and public health measures.

The first and most sustainable strategy is to increase dietary diversity. This is based on the principle that if people eat a variety of foods in moderation from the major food groups they are likely to obtain all the nutrients they need for good health, growth and reproduction. The number of food groups varies, but the WHO define eight when judging the quality of complementary foods for young children: grains, roots and tubers (dietary staples); legumes and nuts; dairy products; flesh foods; eggs; beta-carotene rich fruit and vegetables; and other fruit and vegetables.[35] The methods to improve dietary diversity include:

- Improving people's means to obtain sufficient foods from all food groups, such as improved agricultural practices and better varieties of crops such as orange flesh sweet potatoes which contain a precursor of vitamin A;

- Improving household food security (both access & availability) such as homestead gardening to grow food crops throughout the year;

- Improved methods of food storage such a grain or potato stores, or methods of food preservation such as drying to give stability to food access and buffer people from seasonal price changes;

- Providing knowledge about why and how to give a variety of foods e.g. complementary feeding of young children, to improve utilisation.

The second strategy is to fortify foods with nutrients that may be lacking in the diet. The methods include:

- Adding micronutrients to processed foods e.g. iron and folate to wheat flour; iodine to salt;

- Biofortifying foods by plant breeding, although to increase the concentration of minerals requires that they are present in the soil in the first place.

The third dietary strategy is to supplement the diet with missing nutrients. The methods
include:

- Giving food providing energy and macronutrients e.g. ready-to-use food for children aged 6 – 59 months or biscuits for school-age children;

- Giving vitamins and minerals e.g. drops, pills or powders;

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[35] WHO (2008). *Indicators for assessing infant and young child feeding practices. Part 1. Definitions*. Geneva: World Health Organization.

- Giving other essential nutrients e.g. fatty acids.

The fourth strategy is to prevent diseases by measures such as vaccination and insecticide treated bed nets; by keeping people and their faeces apart through effective sanitation; and by providing clean water for people to drink.

Of the three nutritional strategies the first priority should, whenever possible, be dietary diversification, but this typically requires time and substantial investments in people's ability to obtain their own food throughout the year, so is a long term goal.

The second priority is usually fortification, but this requires that people be able to purchase fortified foods, so is typically an approach used in wealthy and middle income countries where most people buy processed foods. Wheat flour is fortified in Pakistan with iron and folate but this product may not be bought by the rural poor who take their wheat to a local 'chakki' mill to be ground. Salt is a good vehicle for delivering iodine because it is consumed by everyone and the amount consumed is self-limiting, but the additional cost of iodisation may put off poor people who may use natural rock salt that is cheap and not fortified.

The third priority is usually supplementation, but this is not sustainable in the long term except for during particular stages in the life cycle where the risk of malnutrition is greatest, such as pregnancy, or during emergencies when food security is disrupted. Supplements are a short term method to improve the nutritional status of the poor while programmes that increase their ability to diversify their diet are put in place. Giving supplements can also be used as a focus for nutrition education and other complementary activities.

The fourth main strategy to improve nutrition lies in public health measures: treatment of infections, ideally early in the course of disease so that children start to recover quickly; vaccinations to prevent infections and disease; clean water to protect people from directly transmitted diarrhoeal diseases; and educational interventions to promote breastfeeding, complementary feeding and reducing disease transmission by hand washing. Many of these measures were the subject of an influential series of articles in *The Lancet* including one by Bhutta and colleagues on 'What works'.[36] This article has been influential because it attempted to quantify the impact of interventions on nutritional outcomes such as z-scores and the risk of low birth weight, for example.

This means that the best methods to improve people's nutritional status deal with the basic and underlying causes of malnutrition and enable people to provide the food and health services that they need to live and raise well nourished children. These methods tend to be sustainable. In the short term, methods that address the immediate causes of undernutrition can have quick effects, but tend to be unsustainable. For example, most people should be able to get all the vitamins and minerals they need from their diet and supplements should be unnecessary.

With these strategies in mind the next section focuses on additions to DFID programmes in Pakistan that could have nutritional outcomes. There is greatest potential for adding interventions to DFID programmes in Education and Health but there may be a micro-economic opportunities for new programmes in Economic Growth, while trying to change government policies can also have effects on nutrition.

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[36] Bhutta, Z.A., T. Ahmed, R.E. Black, S. Cousens, K. Dewey *et al.* (2008). What works? Interventions for maternal and child undernutrition and survival. *Lancet*, **371** (9610): 417-440.

Governance

In the field of Governance there are issues that could be raised with government that could have a major impact on food security and nutrition:

- Policies to raise incomes for farmers such as allowing wheat prices to fluctuate with global prices rather than fix them arbitrarily, but this then requires . . .

- . . . policies to protect the poorest people from high food prices.

- Policies that promote the redistribution of land and makes it available to poor landless farmers.

- Policies to create employment such as free trade zones for adding value to goods for export.

- Policies and programmes to improve infrastructure so that jobs can be created across the country, not just near to the coast;

- Finally, nutrition could be raised as a key indicator of national and provincial development, irrespective of whether it was being directly or indirectly affected by any policy programme; the target should simply be to reduce the prevalence of underweight as an indicator of the health of the nation.

5.1   Economic growth programme

The main economic programme that could be considered to have nutritional outcomes, both direct or indirect, is micro- rather than macro-economic.   Although homestead gardening programmes were developed initially to prevent nutritional blindness caused by a deficiency of vitamin A, which can be manufactured in the body from the orange and yellow pigments called carotenes found in green leafy vegetables and yellow or orange fruit, eventually it came to be realised that such programmes also generated income, often for women. In a typical programme a farmer with a modest area of land is supported to develop a community garden in the village which becomes a commercial source of seeds, seedlings and saplings. Such community gardens often become a self-sustaining business. The community farmer is trained to pass on expertise and skills to his or her customers in things such as pest control and composting. Participants then develop small areas of land around the house to grow a variety of leaves and vegetables that can provide food throughout the year, often using indigenous varieties. The excess production is either bartered for other food or sold. Studies have shown that women often spend the income on buying other foods, or pay for health care or education for their children, which is to a modest degree empowering.[37] Such programmes have been very successful in Bangladesh and have been expanded into homestead food production involving rearing chickens, ducks and animals such as goats and cows for meat and milk. Small scale milk producers have then linked up with milk companies that collect and process milk to add value. BRAC, the largest NGO in the world, created a dairy company as a social enterprise in 1998 which now sells milk and milk products throughout Bangladesh.

The cost of implementing such a programme is unknown, but the potential for creating small businesses, for generating income by households, and for

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[37] Bushamuka, V.N., L. Kiess, M. Bloem, D. Panagides, S. de Pee *et al.* (2005). Impact of a homestead gardening program on household food security and empowerment of women in Bangladesh. *Food Nutr Bull*, **26** (1): 17-25.

empowering women, is such that many NGOs in Bangladesh, including all the largest, have had or still have large scale homestead gardening programmes.

5.2   Education programme

Although every Pakistani child has a constitutional right to go to school, an estimated 7 million children are not enrolled, the majority of whom are girls. A study in rural KP in 2006 found that 50% of girls and 20% of boys were not enrolled.[38] Enrolling girls in school and keeping them enrolled could delay marriage and the first pregnancy and reduce the risk of dying during childbirth. Although adolescent girls may have secondary sexual characteristics, they are not physically developed enough to bear children until they are 18 years or even older, especially if they have been undernourished and have experienced a delayed puberty. Stunted children have been shown to enrol late in school.[39]

There are a number of mechanisms and interventions that can be supported or applied to develop school-based health and nutrition services. For example, basic school health services such as deworming and micronutrient supplements can be provide periodically to all enrolled pupils. These can serve to improve the perceived value of schools to parents, provided that fears can be overcome that children are not being harmed (see *Risks and Threats*, below).

A school-based health programme requires cooperation between the health sector (technical) and education sector (delivery and instruction), so an inter-sectoral committee is important at Provincial and District levels to coordinate activities. Representatives of the non-formal education sector may be included so that the programme can be expanded.

Schools provide an opportunity for health education for both girls and boys about nutrition, food groups, dietary diversity, caring for women during pregnancy, and feeding and caring for young children. The costs of adding health education topics to the curriculum and of developing materials is not known, but Save the Children USA have substantial experience in this field in Pakistan. The topics need to be appropriate to the children's age; the nutritional content and messages need to be locally relevant and appropriate; while the nutritional needs of pregnant and lactating women and infants need to be known by both boys and girls. The most important lesson I have learned from experience of health education developed for schools in other countries is that the topics and materials should be mainstreamed in the curriculum otherwise they may be viewed by teachers as peripheral or optional, and may not be taught.

School teachers can administer treatments for intestinal worms twice a year to schoolchildren when the prevalence of infection is 50% or higher.[40] School teachers have been shown to be prepared and able to give weekly or bi-weekly supplements of micronutrients.[41,42] School-age children may also benefit from a capsule of vitamin

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[38] Hall, A. and H. Kirby (2010). The numbers, educational status and health of enrolled and non-enrolled school-age children in the Allai Valley, Northwest Frontier Province, Pakistan. *Social Science and Medicine*, **70** (8): 1131-1140.

[39] Partnership for Child Development (1999). Short stature and the age of enrolment in Primary School: studies in two African countries *Social Science and Medicine*, **48** (5): 675-682.

[40] WHO (2006). *Preventive chemotherapy in human helminthiasis*. Geneva: World Health Organization, pp

[41] Hall, A., N. Roschnik, F. Ouattara, I. Toure, F. Maiga *et al.* (2002). A randomised trial in Mali of the effectiveness of weekly iron supplements given by teachers on the haemoglobin concentrations of schoolchildren. *Public Health Nutrition*, **5** (3): 413-418.

A twice a year, especially in places where the consumption of vegetables is seasonal.

The cost of these providing treatments is relatively low; the main costs arise from delivery, because at least one teacher needs to be trained in each school in how to administer treatments, but ideally two, in case one teacher leaves. This could be included in annual in-service training or a cascade system of training can be applied.

Albendazole, a single dose drug to treat intestinal worms, costs USD 0.0198[43] per dose, so two doses would cost about 4 US cents per child per year. The costs of delivery in programmes in Ghana and Tanzania were 4 and 3 US cents respectively[44] but they will depend on the unit costs of teachers' time if this is seen as an opportunity cost.

The benefits to children's nutritional status should not be seen as automatic. Giving a drug such as albendazole only removes a parasite that contributes to undernutrition, it does not provide the nutrients a child needs in order to gain or regain weight or height, they can only come from the diet. The number of children who will benefit will depend on the initial prevalence of infection, but repeated treatment will serve to lower the risk of reinfection and will have externalities for the rest of the community, as school-age children are the main sources of infection. The effect of keeping children free of heavy worm burdens can only be measured in comparison with similar but untreated children, so the specific nutritional effects of deworming and of reducing transmission will be mostly unquantifiable. However the number of children dewormed every year is a simple and direct indicator of service delivery that is appealing.

A tablet containing six minerals and ten vitamins, designed for daily consumption by pregnant women but which can be given twice a week to schoolchildren, costs USD 0.0166 per dose. A typical course of supplements, two tablets a week for 12 weeks once a year, would therefore cost about USD 0.40 per child per year. The low dose of vitamin A is safe even for a girl who unknowingly might be pregnant, although this is an unlikely event. It is inadvisable only to treat specific target groups such as adolescent girls because teachers may decide to share tablets among all children.

Some school health programmes have given children just a mega-dose capsule of 200,000 IU of vitamin A costing USD 0.0183 per capsule, followed by tablets of iron and folate. Both can be necessary to treat anaemia, not just iron, and may have effects on growth as well.[45] A capsule of vitamin A costs USD 0.0183, so < 4 US cents per child per year. No price for iron/folate tablets was obtained, but they are very inexpensive so that a 12 week course of 2 tablets a week could costs <10 US cents per child.

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[42] Roschnik, N., A. Parawan, M.A. Baylon, T. Chua and A. Hall (2004). Weekly iron supplements given by teachers sustain the haemoglobin concentration of school children in the Philippines. *Tropical Medicine and International Health*, **9** (8): 904-909.
[43] All prices quoted here are for items in the UNICEF catalogue, denominated in USD. Thanks to Dr Teshome of UNICEF for providing this information.
[44] Partnership for Child Development (1999). The cost of large-scale school health programmes which deliver anthelmintics to children in Ghana and Tanzania. *Acta Tropica*, **73** (2): 183-204.
[45] Mwanri, L., A. Worsley, P. Ryan and J. Masika (2000). Supplemental vitamin A improves anemia and growth in anemic school children in Tanzania. *Journal of Nutrition*, **130** (11): 2691-2696.

The dose and annual cost of treatment, excluding delivery costs are summarised in Table 3 below. Delivery costs will be context specific but can be minimised by using existing delivery mechanisms unless the extra cost of delivering the intervention is disaggregated and costed separately.   In Tanzania and Ghana it was estimated in the late 1990s that it cost it cost about USD 0.05 per child to deliver deworming treatments to children in schools.[46] Given that salaries and prices for petrol and vehicles have increased, it is likely to be more than that now while the cost of treatments has fallen to about USD 0.02 per child. This means that delivery costs may now be much more than 200% of the treatment costs. The cost of delivering treatments to children in Pakistan will need to be assessed, but as teachers can administer treatments and there are usually supply lines to schools, the delivery costs can be minimised and the time spent by teachers and the opportunity costs to the education system can also be kept low.

Table 3. The dose and annual costs of three simple nutrition interventions that could be provided to children in schools.

Treatment	Cost in USD	
	Dose	Annual
Albendazole, 400 mg	0.0198	0.04
16 multivitamins & minerals	0.0166	0.40
Iodised oil 200 mg	0.7500	1.50
Vitamin A 200,000 IU	0.0183	0.04

Finally, a couple of interventions that are not recommended unless in special circumstances are described briefly next. School feeding has been claimed to be an effective method in Pakistan to improve enrolment and children's nutritional status,[47] but it is costly and expensive to administer, mainly because of the delivery costs of food unless they are locally sourced. An analysis of costs in different countries show a range from USD 28 to USD 63 per child per year with an average of USD 40.[48] Baked biscuits are usually the least expensive option. If food is available locally, schools may be funded to purchase and cook it for pupils, a measure that can serve to stimulate the local economy.

School first aid kits are also expensive to deliver and to maintain and do not have easily measurable benefits to children's health. A large programme supported by the UK Overseas Development Administration and administered by the British Council in southern India (perhaps Tamil Nadu) was abandoned in the middle to late 1990s.

5.3   Health programme

The first 1000 days of a child's life has become a focus of health and nutrition programmes.[49] This period covers conception to the end of the second year of life

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[46] Partnership for Child Development (1999). The cost of large-scale school health programmes which deliver anthelmintics to children in Ghana and Tanzania. *Acta Tropica*, **73** (2): 183-204.
[47] Pappas, G., A. Agha, G. Rafique, K.S. Khan, S.H. Badruddin *et al.* (2008). Community-based approaches to combating malnutrition and poor education among girls in resource-poor settings: report of a large scale intervention in Pakistan. *Rural Remote Health*, **8** (3): 820.
[48] Galloway, R., E. Kristjansson, A. Gelli, U. Meir, F. Espejo *et al.* (2009). School feeding: outcomes and costs. *Food Nutr Bull*, **30** (2): 171-182.
[49] Anonymous (Undated). *Scaling up nutrition. A framework for action.* None: Multiple agencies.

and is best viewed as a continual process involving the health and welfare of the mother as well as her child.   The current Maternal and Newborn Health Programme involves district hospitals, community midwives and traditional birth attendants (TBA), all of which have the potential to deliver additional or improved nutritional interventions during pregnancy and the newborn period.

The interventions analysed in the Lancet paper by Bhutta et al. in 2008[50] offer a menu of the most commonly applied and most likely interventions to reduce child mortality and prevent malnutrition (table 4 below)

Table 4: Direct evidence-based interventions that affect maternal and child nutrition

Evidence for implementation in 36 countries where 90% world's stunted children live	Evidence for implementation in specific situational contexts
Maternal and birth outcomes	
Iron/ folate supplementation	Maternal supplements of balanced energy and protein
Multiple micronutrient supplements	Maternal deworming in pregnancy
Maternal iodine through iodisation of salt	Intermittent preventive treatment for malaria
Maternal calcium supplementation	Insecticide-treated bed nets (malaria)
Newborn	
Promotion of breastfeeding	Neonatal vitamin A supplementation
Infants and children	
BCC for improved complementary feeding	Conditional cash transfer programmes (with education)
Zinc supplementation	Deworming
Zinc in management of diarrhoea	Iron fortification and supplementation programmes
Vitamin A fortification/ supplementation	Insecticide-treated bed nets (malaria)
Universal iodisation of salt	
Hand washing or hygiene interventions	
Treatment of severe acute malnutrition	

The paper describes weighted models that were created of the statistical effect on the prevalence of stunting of eight interventions and what was called the 'relative reduction' in the prevalence of stunting, which was estimated for children aged 12, 24 and 36 months. The results of these models are shown in Table 5 below:

Table 5. The estimated effect of nutrition-related interventions on stunting in children in 36 countries

Intervention	Relative 'reduction' in prevalence of stunting at:		
	12 months	24 months	36 months
Balanced energy and protein supplements	1.9	0.5	0.3
Intermittent preventive treatment of malaria	1.4	0.3	0.1
Multiple micronutrients during pregnancy	0.9	0.3	0.1
Breastfeeding	0.0	0.0	0.0
Complementary feeding and others	19.8	17.2	15.0
Vitamin A supplements	0.0	0.0	0.0
Zinc supplements	9.1	15.5	17.0
Hygiene interventions	1.9	2.4	2.4

The use of the term "reduction" in context of stunting in the paper is a little misleading; most of these interventions do not reduce the prevalence of stunting, they prevent stunting from occurring so that the treated children are less stunted than

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[50] Bhutta, Z.A., T. Ahmed, R.E. Black, S. Cousens, K. Dewey *et al.* (2008). What works? Interventions for maternal and child undernutrition and survival. *Lancet*, **371** (9610): 417-440.

untreated children. The actual estimate is a difference between two groups, one treated and one untreated. For example hygiene interventions prevent diarrhoeal disease which could lead to a deterioration in anthropometric status by 2.4% at 24 months, they do not lead to a 2.4% reduction in the prevalence of stunting, it is 2.4% lower in the group which are protected from diarrhoeal diseases. There is no active reduction in prevalence, there is prevention.

The lesson from this is that the best way to capture an effect of programmes is to study a cohort from birth over the first 2 to 3 years of life while efforts are made to prevent them from becoming malnourished, ideally in comparison with an untreated cohort so that the attributable impact of the programme can be estimated. The attributable difference will be the degree of malnutrition prevented or proportion of children of children who do not become malnourished. To obtain a drop in the prevalence of existing malnutrition it will be necessary to treat children.

The first thing to note from Table 5 is that neither breastfeeding nor vitamin A supplements have any effect on preventing stunting. The lack of effect of breastfeeding may be because it prevents malnutrition mostly in the first 6 months of life and any effect is lost by 12 months. There is no evidence that breast milk can meet the needs for energy of all children for their after the first 6 months of life, breast feeding mainly serves to avoid the risk of disease which can lead to malnutrition.

The second noteworthy point is that five of the other interventions have relatively small effects and that zinc supplements and complementary feeding have effects at 36 months of age that are six time greater than the greatest effect of the most effective other intervention, hygiene interventions.

The nutritional impact of other interventions is difficult to assess and the effects of treatment are often poor. For example, deworming also prevents a deterioration in nutritional status if there is intense transmission of infections in the first place, which is context specific. There are few data available on the prevalence of worms in rural Pakistan, most are from urban areas. Deworming is also not a treatment for any form of existing malnutrition, so the effects of treatment on anthropometric measurements will be very small and slow. Recovery of lost growth or weight gain due to worms requires nutrients after treatment, which may explain why deworming is in the second category of context specific interventions, rather than why it is not a useful intervention.

For these reasons it may be best to divide the menu of interventions analysed in the Lancet papers into those that provide nutrients directly to promote growth, such as complementary feeding, and those that prevent disease which can cause malnutrition. For example vitamin A supplements are thought to prevent or mitigate infectious disease, but apparently have no effect on stunting, only on the risk of dying.   In contrast zinc supplements appear to have a substantial effect on the prevalence of stunting, probably because of their role in many key metabolic enzymes, but only a small effect on the risk of dying, presumably due to their small effect on the risk of fatal diarrhoeal disease. Another review showed that the magnitude of the effect of zinc supplements on linear growth was positive and linear above a mean z-score of -1.5, but had no effect when the z-score was lower than this[51] so the relationship is dependent on context as well, something that the paper by Bhutta et al.[52] did not take into account.

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[51] Fischer Walker, C.L. and R.E. Black (2007). Functional indicators for assessing zinc deficiency. *Food Nutr Bull*, **28** (3 Suppl): S454-479.
[52] Bhutta, Z.A., T. Ahmed, R.E. Black, S. Cousens, K. Dewey *et al.* (2008). What works? Interventions for maternal and child undernutrition and survival. *Lancet*, **371** (9610): 417-440.

The analysis in the Lancet supports the recommendation of this report to promote complementary feeding of young children with foods from multiple food groups, providing that it is affordable (which is where the cost of the diet analysis comes in) with the addition of micronutrient powders to that food, which contain zinc. Deworming can help prevent malnutrition after the age of 1 year, especially where the prevalence of infection in schoolchildren (the indicator group) is >50%.

The evidence of a widespread iodine deficiency among women of reproductive age calls for specific short term measures while concerted efforts are made to increase the coverage and use of iodised table salt, which is very low in Pakistan (see Risks and Threats, below). This means either giving supplements of iodised oil,[53] which cost USD 0.75 each or multiple micronutrient supplements that contain iodine in the form of tablets or as a powder to add to food. The dose of 150 µg of iodine in the UNICEF tablet is lower than recommended during pregnancy.54 However, the long term strategy to control iodine deficiency disorders is the universal iodisation of salt and its use daily for feeding both humans and their animals.[55]

All pregnant women will benefit from micronutrients during pregnancy. These should include iron/folate, as well as vitamins. All could be combined as multiple micronutrient supplements taken on a daily basis – at a cost of USD 3 for a 6 months supply to be taken during second and third trimesters. Research to asses the best means of ensuring compliance and reduction of anaemia (iron/ folate tablets plus vitamins vs. multi micronutrients) is indicated

When women have given birth they could be given 400 mg iodine if they had not received treatment within the previous year, and 200,000 IU of vitamin A, within the six-week window of safety recommended by the WHO (a large dose of vitamin A may cause foetal damage during pregnancy). These capsules could boost the secretion of both vitamin A and iodine in breast milk, the child's sole source of all nutrients for the first few months of life. These micronutrients could be included with safe birth kits provided to midwives and TBAs.

There is a potential role for multiple micronutrient powders (first developed in Montreal, Canada), often known by their north American registered trade name, 'Sprinkles'. One packet is added to complementary foods each day. The packets currently sold in Pakistan are imported from Canada, and cost PKR 3.5 each (about 4 US cents), but use a premix of four vitamins (A, C, D and folate) and three minerals (iron, zinc and iodine). The packaging contributes to about 25% of the cost. These costs could be reduced considerably by importing a premix from a closer, less expensive source. An alternative is to provide the powder in a small plastic bottle with a scoop, to reduce costs. There is no reason why the powder could not be added to the food of the whole family. These powders need to be named and packaged so that they appeal to the local market, an issue for social marketing.

There is potential to promote exclusive breastfeeding by women, which should involve mothers-in-law and husbands. There is potential to improve complementary feeding by using the foods consumed by the rest of family, by ensuring that foods

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[53] Andersson, M., B. de Benoist, F. Delange and J. Zupan (2007). Prevention and control of iodine deficiency in pregnant and lactating women and in children less than 2-years-old: conclusions and recommendations of the Technical Consultation. *Public Health Nutr*, **10** (12A): 1606-1611.
[54] Andersson, M.,ibid
[55] UNICEF (2007). *Sustainable elimination of iodine deficiency. Progress since the 1990 World Summit for Children*. New York: UNICEF.

from four or more food groups are used to increase the diversity of the diet, by enriching complementary foods with micronutrients, and by increasing the energy density of the food with oils. These methods are described in WHO documents.[56]

The relatively high prevalence of wasting and the presence of large numbers of children in Pakistan who are moderately wasted is likely to bring pressure to bear to support programmes of treatment using ready-to-use food (albeit expensive) such as Plumpy'nut, which is a recognised and effective treatment for severe wasting. There is a humanitarian need for therapeutic feeding especially during an emergency when children are at risk of dying from infectious diseases, when household food security is poor, and when a mother's ability to care for her children may be affected, but in the long run the need is to prevent wasting by improving the diet when people are settled and secure. This can best be done by promoting breastfeeding, by promoting complementary feeding, and by improving the quality of both methods using micronutrient supplements given to both children and women. It may be more cost effective to treat moderate wasting by increasing poor mothers' ability to buy and prepare nutritious food at home, perhaps by cash transfers, empowerment and training, than to set up a community based treatment programme using RUTF. A study in Zambia showed that community based treatment for severe wasting cost between USD 140 - 270 per child treated[57] so similar costs for treating moderate acute malnutrition in the same way should be expected.

Cash transfers
Cash transfers do not, however, have a good record as a treatment for nutrition, through the situation may be different in Pakistan. The Cochrane Collaboration conducted a meta-analysis of the effect of conditional cash transfers on health outcomes in 2009.[58] Ten papers reporting data from six studies were analysed. The analysis showed evidence of effects on nutritional status and health, but it was hard to attribute the effects specifically to the cash transfers as other components may have contributed. (attribution is a recurring issue raised throughout this report, especially when multiple interventions are taking place at the same time) Positive effects on anthropometric status were found in three studies, two cluster RCTs and one controlled before and after study, but one study found a negative effect. No estimates were made of the pooled effect, probably because the number of studies with the same measured outcome was too small.

Two particular studies are noteworthy, one linked to an educational intervention and one with negative effects.

A conditional cash transfer programme was implemented in 6,400 poor communities in Mexico.17 The cash amounted to a maximum of $90 for a household containing primary school children and $160 for a household containing secondary school children and was conditional on children's enrolment in school and parents attendance at health education sessions. A total of 506 poor communities were randomly sampled in proportion to size and 306 were randomly assigned to start receiving the cash transfers in April 1998 while the remaining 200 were started 20

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[56] WHO (2009). *Infant and young child feeding: Model Chapter for textbooks for medical students and allied health professionals*. Geneva: World Health Organization, pp 111.
[57] Bachmann, M.O. (2009). Cost effectiveness of community-based therapeutic care for children with severe acute malnutrition in Zambia: decision tree model. *Cost Eff Resour Alloc*, 7: 2.
[58] Lagarde, M., A. Haines and N. Palmer (2009). The impact of conditional cash transfers on health outcomes and use of health services in low and middle income countries. *Cochrane Database Syst Rev*, (4): CD008137.

months later, in December 1999. This is a good stepped wedge design (see Section 6.3). The impact on reproductive health outcomes was assessed in a sample of women in each group of communities who had given birth to a single child, 606 and 419 children respectively, in the intervention and control communities. After adjusting for a large number of individual, household and community characteristics, a small difference of 127 g (P = 0.02) in birth weight was found and a 4.6% lower risk of having a low birth weight baby (P = 0.05).[59]

During a conditional cash transfer programme in Brazil young children in beneficiary households were compared with children in households that had been selected for the programme but were excluded as a result of 'quasi-random administrative errors'.[60] For example, potential beneficiaries were mistakenly rejected by a computer programme because their name included a non-standard character such as é, ô or ç, which was presumed to be randomly distributed among potential beneficiaries. Data on anthropometric measurements were obtained from growth monitoring cards. Six months after the start of the programme the children of beneficiaries had a weight-for-age that was 0.13 z-scores lower (worse) than non-beneficiaries. There was also an inverse dose-response relationship: each additional month in the programme was associated with a rate of weight gain in the intervention group that was 31g lower (worse) than in the control group and amounted to about 180g over six months. This was attributed to the fact that mothers may have thought that their participation was dependent on their child being underweight and that their benefits would be lost if the child started to grow well.

A global meta-analysis of 17 studies of 16 cash transfer programmes in poor countries conducted by researchers at Towson University (as yet unpublished: personal communication) found that the weighted impact of all estimates was close to zero, meaning that they had no overall effect. Programmes of conditional cash transfers showed significant negative impacts on z-scores of height-for-age. The authors came to conclusions about differences between effects on girls and boys and higher marginal effects in the poorest countries, but none of the trends was statistically significant.

The meta-analysis[61] only found five studies which had analysed data on z-scores of weight-for-height, which did not permit a substantive co-factor analysis. The authors concluded that 'the findings on HAZ (z-score of height-for-age) are somewhat likely to apply also to WAZ (z-score of weight-for-age), WHZ ((z-score of weight-for-height) and BAZ ((z-score of BMI-for-age)'. This means that no effect on the wasting was expected either, though the rationale for this is not clear,

The major issue for any programme is delivery mechanisms and delivery costs. These will both depend on local circumstances, and health service delivery mechanisms. For example, vitamin A and deworming are often administered to children as a component of immunisation campaigns, so the additional costs can be small.

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[59] Barber, S.L. and P.J. Gertler (2008). The impact of Mexico's conditional cash transfer programme, Oportunidades, on birthweight. *Tropical Medicine and International Health*, **13** (11): 1405-1414.

[60] Morris, S.S., P. Olinto, R. Flores, E.A. Nilson and A.C. Figueiro (2004). Conditional cash transfers are associated with a small reduction in the rate of weight gain of preschool children in northeast Brazil. *Journal of Nutrition*, **134** (9): 2336-2341.

[61] Manley, J., S. Gitter and V. Slavchevska (2001). *How effective are cash transfer programs at improving nutritional status?*: Towson University Working Paper No. 2010-18.

Hence delivering nutrition interventions through existing health service delivery mechanisms is key to reducing costs. If Lady Health Workers visit children at home for any reason then the extra cost of deworming children, for example, may be negligible and may even serve to strengthen the role of such women in the community. The now defunct Japanese Integrated Family Planning and Parasite Control Project used deworming as a means to improve the credibility and uptake of the main programme, which was to offer family planning. An analysis of delivery opportunities in the government health system may provide other opportunities. An alternative is to have health fairs, such as those organised in Parishes in Uganda, where health services and health education are offered. This may not be so effective in a conservative society such as Pakistan where women may be restricted in their movements outside the home.

The main challenge is thus to identify existing opportunities to deliver interventions that minimise delivery costs. Lady Health Workers and Community Midwives seem to be the most likely means of delivering interventions to very young children to prevent them from becoming malnourished. The basis of any apportionment of costs is likely to be the time they spend on these activities.

As the delivery mechanisms for nutritional interventions are unclear and as there are, no up to date data from Pakistan on delivery costs then it is not possible to make any estimates of cost effectiveness. This will require a costing exercise to explore possible options.

A key issue is the question of making a transition from humanitarian nutritional responses during an emergency, which are largely based on providing food such as ready-to-use food (RUTF), to long term nutrition programmes. In both circumstances moderately and severely malnourished children are identified weight-for-height: a z-score of less than -3 standard deviations is used to classify a child as severely wasted and usually makes the child eligible for therapeutic feeding because of the risk of dying from infectious disease. A child with a z-score of less than -2 is classified as moderately wasted. The z-score of height-for-age is not usually used to classify children for therapeutic feeding in an emergency.

The data from the Punjab indicate that typically about 7.8% of children are wasted and 5.7% are severely wasted, making 13.4% in total.[62] This means that even in 'normal' times, about 6% of Punjabi children would be eligible for therapeutic food if they were located and identified. This indicates a need for screening, probably by Lady Health Workers, and referral to a centre for assessment and then supplementary feeding, either in the referral centre or using take-home RTUF such as Plumpy'Nut. The problems with the former are that mothers have to stay away from home when they have other children to care for, and the risk of disease transmission. The risk of the latter is that food taken home may be shared so the effect is reduced.

The basis for decision making for populations is usually the prevalence of wasting plus aggravating factors. WHO classify a prevalence of wasting of more than 15% as 'critical' but in some places, such as northern Kenya, the typical prevalence of wasting is 20% or higher, so the simple application of this threshold is questionable. What some countries do, such as Ethiopia, is to assess additional 'aggravating

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[62] Government of Punjab (2009). *Multiple Index Cluster Survey (MICS) Punjab 2007-08*. Punjab: Planning and Development Department, Bureau of Statistics, Government of Punjab, pp 243.

factors', such a drought, flooding or disease epidemics; however it is not clear how those factors are measured and reported.[63]

During a flood people are usually unable to feed themselves, so emergency food is needed. Ready-to-use food (RTUF) has been widely used to treat severely wasted children in these situations. The transition takes place at the point when communities are able to access/ produce their own food again. Key to managing these situations is ensuring that health systems have the capacity to identify and treat wasted children. Assessing the capacity of the health system in Pakistan has been beyond the scope of this review.

In the long term it is recommended that Lady Health Workers should be trained to screen children and identify those who may be severely wasted and refer them to therapeutic treatment centres. Ideally that process of screening would identify all wasted children, and exclude children who were not wasted. However, diagnostic measures (for example, median upper arm circumference, MUAC) achieve this target. At the treatment centre children should be assessed, underlying infections diagnosed and treated; those children considered well enough could be discharged home with a month's supply of RUTF. There are protocols that describe this process.

5.4   Conclusion

Several of the new interventions proposed that could impact on nutritional status could be delivered though current DFID programmes. Future DFID programmes – especially those addressing health system strengthening – should ensure that nutritional interventions are incorporated in the design (depending on the scale/scope of programme this could involve health worker training, micronutrients, BCC etc.) Schools offer a delivery mechanism for simple treatments such as deworming and micronutrient supplements.

6. Measuring nutritional status and attributable impact

An objective of this review was to identify appropriate nutrition indicators. DFID has already identified two levels of key nutrition indicators – compiled and core; DFID should continue to use these. Two questions arise: how such data can be obtained; how the impact of nutrition interventions can be measured. From the outset, this will require careful programme design.

6.1   Collecting data and additional indicators

Demographic and health surveys, even if conducted every 5 years, or occasional MIC surveys in different provinces will not provide data often enough to monitor trends and meets the needs of typical DFID programmes. It may be best to consider supporting a surveillance system to collect data for all programmes, not just to assess changes in nutritional indicators. The detail and depth of nutritional data need not be as great as in the recent national nutrition survey; a multiple indicator surveillance system could operate across DFID-supported programmes in, for example, education, economic growth, as well as health.   For example data being generated by the current 6-monthly education surveillance system in all 36 Districts of the Punjab could be merged with a system to collect data on nutritional and economic indicators as well. The frequency of nutritional data should ideally be

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[63] Watson, F., B. Negussie, C. Dolan, J. Shoham and A. Hall (2011). Quality and potential use of data collected during nutrition surveys: an analysis of surveys in Ethiopia. **3** (2): 85-90.

related to the seasons in Pakistan, so that fluctuations in nutritional status can be detected. In a country such as Bangladesh the prevalence of wasting typically fluctuates between 7% to 13% or so throughout the year with the highest prevalence occurring during the monsoon as a result of disease and when stocks of food have been depleted and people await the next harvest. An indicator of nutritional robustness is a lack of variation.

A multi-sector surveillance system could be coordinated through the DFID results team to avoid duplication of efforts and increase the efficiency of funding. Such a system could also meet the needs for information of provincial governments about coverage and access to services. There are plans being developed for a nutritional surveillance system in KP which could be supported to become a multiple indicator surveillance system for several programmes, including education and economic activities.

There are some indicators that may need to be applied specifically to Pakistan or even developed specifically. For example, it seems that the prevalence of wasting should be a core indicator, not just during an emergency, and could be viewed as an indirect indicator of the empowerment of women, particularly among women with education and in households with substantial resources.

It would be useful to have a separate indicator of the ability of women to control the diet and health care within the household, especially for herself and her children. This could be a composite of the ability to choose or buy foods for family meals; control over the allocation of resources for food and health care; the ability to prepare family meals; the order in which women and children eat in the family and have access to the most nutritious foods; the care received by women during pregnancy and childbirth; the ability to take children to a health facility when sick; the relative priority given to female children; and the vaccination status of children. There may be more indicators that could be compiled into a composite indicator of domestic empowerment of women.

6.2   Attributing the impact of programmes on nutritional indicators

There are significant difficulties with attributing the general impact of programmes on nutritional indicators. These problems are captured in Figure 4. The typical assumption of a 'before and after' or 'pre-post' evaluation is shown in Figure 4A. Three other possible mistaken conclusions or inaccurate estimates of the nutritional impact of an intervention are also shown. All of them show that, because indicators of anthropometric or nutritional status may change for the better or worse without an intervention, an untreated control or comparison group is needed to estimate the magnitude of the impact that is attributable to the intervention.

The second problem lies in separating the effects of different programmes which may act on the same individuals or households, or of detecting the effect of any programme when other development activities that operate in the same locality and may also have nutritional effects. This requires a control group that receives nothing, which is usually impossible to achieve.

But even if there are problems in estimating the attributable effects of a specific activity of activities, it can be argued strongly that nutritional indicators are key measures of national and social development and need to be measured (see *Nutritional indicators of impact and progress*, below).

There is an issue over whether programmes should address stunting or wasting – or both. First, it should be pointed out that the DFID Nutrition Strategy was to tackle both acute and chronic malnutrition, which are represented by wasting and stunting. Second, stunting, wasting and underweight are different manifestations of undernutrition and have the same causes, albeit over different periods of time, so they should not be seen as different entities. Wasting represents a sudden loss of weight, either due to an acute lack of food (hunger in the old sense of the word) or recent acute disease which increases metabolic rate and suppresses appetite for whatever food is available, though it is often poor. Stunting represents chronic undernutrition, which could be of energy, protein or micronutrients, and/or but typically and, repeated episodes of infectious diseases without a good convalescent diet to recover lost weight and growth. Underweight is a composite which captures both wasting and stunting. Given that stunting in Pakistan seems to be intractable and probably has an inter-generational component and that underweight is a MDG indicator, it is recommended that underweight could be the key focus of programmes and the key indicator or effectiveness, if that is to be measured. To assess underweight it is necessary to know weight and age in months; if these are being measured it does not require much extra effort and simple equipment to measure length or height so that height-for-age, weight-for-height and BMI-for-age can also be calculated. For one extra measure three additional indices can be calculated which give slightly different insights into undernutrition.

For statistical reasons it is recommended that DFID should require that all reports of surveys and evaluations should include the underlying z-scores with their standard deviations.

Figure 4, A to D. Examples of how the attributable benefit of an intervention can be mistakenly estimated using an example of the prevalence of wasting, a common target of nutritional interventions during an emergency, measured twice, over a period of time. Also shown is what might have happened to concurrent comparison group. The value of delta (Δ) is the attributable benefit under each different circumstance.

A. Mistaken conclusion 1: the attributable benefit is estimated by measuring the difference in prevalence between T_0 and T_1 which is assumed to be due to the intervention because it has fallen.

B. Mistaken conclusion 2: the attributable benefit is underestimated because the prevalence of wasting would have increased without the intervention.

C. Mistaken conclusion 3: the attributable benefit is over-estimated because the nutritional situation improved concurrently and the prevalence of wasting would have fallen anyway.

D. Mistaken conclusion 4: the attributable benefit was not estimated at all because the intervention prevented the prevalence of wasting from increasing, so no change was observed.

6.3   Evaluation designs

There are evaluation methodologies that can capture the attributable impact of programmes, interventions and even policies, on nutritional outcomes.

The first method is nutritional surveillance, the collection of data at regular intervals so that trends can be captured and shown to be statistically significant in their direction. Such data may allow a change in trends to be detected after a policy or programme has been put in place,[64] but such evidence is not particularly strong. A national nutritional surveillance system in Bangladesh has been collecting data six times a year for over 20 years in all Divisions of the country and provides a method of examining national trends in the major indicators of undernutrition as well as examining issues such as the effect on children's nutritional status of the cost of rice as a proportion of expenditure on food.[65] The main limitation is still the lack of controls, although the statistical variance in nutrition and health outcomes could be related to indicators of coverage or participation in other programmes and provide plausible evidence of impact.

The second method is the randomised controlled trial, a method that is being applied to assess the impact of the Punjab Economic Opportunities Programme, which involves skills training for employment and support for rearing livestock. Both activities could have effects on household food security and nutrition, and it has been proposed by this consultant directly to the managers of the programme that indicators of nutrition could be added to this trial. The main limitation is that the trial is only scheduled to last for a year and it may not give enough time for effects to be detected on nutritional outcomes. However, if data are collected on indicators of effectiveness of the programme in generating income for households, it may be possible to detect a dose-response effect – a greater change in nutritional outcomes in households which generate the most income, for example.

The method with perhaps the greatest potential to detect an impact of programmes is the stepped wedge design.[66] [67] [68]This method takes advantage of the fact that programmes can rarely be implemented at full scale from the first day, and that a phased approach is used. If there are sufficient units of programme delivery, such as villages, union councils or districts, 'clusters', and if they could be randomised into phases, then the clusters in the last phase could act as a control for the clusters in the first, second or third phases, depending on how many phases were planned. For example, if a programme was to be implemented in 100 union councils over a period of 4 years then a baseline survey could be done that involves potential beneficiaries in all councils, the programme could be implemented in the first 25 councils in the first year, in

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[64] Lagarde, M. (2011). How to do (or not to do) ... Assessing the impact of a policy change with routine longitudinal data. *Health Policy and Planning*.
[65] Torlesse, H., L. Kiess and M.W. Bloem (2003). Association of household rice expenditure with child nutritional status indicates a role for macroeconomic food policy in combating malnutrition. *Journal of Nutrition*, 133 (5): 1320.
[66] Brown, C.A. and R.J. Lilford (2006). The stepped wedge trial design: a systematic review. *BMC Med Res Methodol*, 6: 54.
[67] Hussey, M.A. and J.P. Hughes (2007). Design and analysis of stepped wedge cluster randomized trials. *Contemp Clin Trials*, **28** (2): 182-191.
[68] Bonell, C.P., J.R. Hargreaves, S.N. Cousens, D.A. Ross, R.J. Hayes *et al.* (2009). Alternatives to randomisation in the evaluation of public-health interventions: design challenges and solutions. *J Epidemiol Community Health*.

another 25 in the second year (total 50), and in another 25 in the third year (total 75). Before the last 25 councils were brought into the programme a final survey could be done and the effects on the beneficiary households in each group of 25 councils could be compared. It might be expected that the effects would be greatest among beneficiaries in the first phase, which had experienced the intervention for three years, than beneficiaries in the second or third phases, an example of a dose-response effect. The process of randomisation is vital, so that any geographical differences between communities within the councils are evenly distributed between the four groups. And there needs to be a good sample size of units of delivery e.g. ≥25 per group so that the groups are similar on average. If the randomisation process is done transparently and involves representatives of the units of delivery, such as union councils, then such a design may be acceptable to communities. The problems with this design are contamination, in which beneficiaries in control clusters cross into intervention clusters to seek participation in the programme, and the effects of concurrent but separate programmes in the same areas. If concurrent programmes affect all beneficiaries equally, then the impact of the intervention under study can be estimated; alternatively, indicators of the effectiveness of concurrent programmes can be used to control for effects on outcome indicators.

6.4   Nutritional indicators of progress and impact

The compiled and core indicators listed above may well be obligatory for DFID, Pakistan to collect and report, however some of these indicators are probably not measurable, or are at least not attributable. This section addresses objective 4 of the consultancy.

The currently available data on nutrition in Pakistan are weak except for the recent DFID/UNICEF survey, so provide a poor baseline from which to try to assess future change. To obtain data on any nutritional indicator it will be necessary to measure representative samples of children and women in their homes. Data collected on children at health centres are not suitable because they represent a self-selected and biased sample. Visits to households provide an opportunity to collect data on other household indicators at the same time, not just on nutrition. Where this is done will depend on whether the data are to be representative of the district, the province or Pakistan as a whole.

If data are to be collected regularly enough to be able to monitor trends in nutritional and other indicators then new data collection systems will be needed. This could be done by annual surveys, but they don't provide data that captures seasonality of food production, food intake and nutritional status, so surveys three or four times a year might be needed in Pakistan. This would have advantages for data collection, as a permanent staff could be employed in order to sustain data quality, something that is difficult to do when new staff are recruited for each survey.

The surveys could be done in fixed, sentinel districts, but the method used to select the districts in the first place would need to be scientifically valid. The villages for each survey should be chosen randomly, so that new households are selected for study in each survey. If the same households are studied continually there is a danger that the nutritional status of children will improve as a result of repeated visits by a team focussing on diets, feeding practices, nutrition and child health which leads to changes in domestic practices. This is known as the Hawthorne effect.

Ideally the organisation that collects the data should be independent of government so that staff can be held accountable for what they do, and so that independent checking of data can be done to ensure quality. The best form of quality control is to revisit households to re-collect data within 24 h of the first visit, to check that data are accurate and correct.

The key indicator group in each household will be children aged 0 – 59 months and the mother of the children. Polygamy will need to be taken into account.

Table 6 lists data that could be collected. A few points are worthy of comment.

An annual survey among a sub-sample of subjects of haemoglobin concentration is proposed as a general indicator of micronutrient status. It does not need to be done more often. The haemoglobin concentration can be measured in the field using a Hemocue haemoglobinometer.

The percentage of wasted children should be included as an indicator in all surveys, not just during emergencies. The data needed (weight and height) are always recorded, so there is no extra cost involved.

The educational status of all other children aged 5 – 19 y in the household could be recorded, but measures should be put in place to avoid the under-reporting of girls.[69]

As the cost of staple foods is likely to fluctuate perhaps more then ever before over the coming years and has a major influence on food consumption. For example the price of rice on the international market increased from $313/tonne in April 2008 to USD1015/tpnne in April 2008 and has since fallen to USD 574/tonne today, but still over 50% higher than it was. It would be useful to collect data on the costs of major food items in local markets as a part of any survey. It may also be useful to estimate the minimum cost of a healthy diet for a typical Pakistani family in each Province using a method and software developed by Save the Children. This would help to assess whether households could actually afford to purchase a nutritious diet for all the family using locally available foods and can suggest specific foods that could be best used to achieve that goal.

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[69] Hall, A. and H. Kirby (2010). The numbers, educational status and health of enrolled and non-enrolled school-age children in the Allai Valley, Northwest Frontier Province, Pakistan. *Social Science and Medicine*, **70** (8): 1131-1140.

Table 5. Possible measurements, indices and indicators to be collected on nutrition and education as part of a multiple indicator surveillance system.

Subject	Measurements or data	Surveys	Sample	Indices	Indicator	Value
Children 0- 59 months	Weight and length or height; sex; age in months	All	All	z-scores of weight-for-age, height-for-age, weight-for-height, BMI-for-age	% underweight, stunted, wasted, thin	Underweight an MDG indicator; indicators of both chronic and acute undernutrition
	MUAC	All	All	MUAC-for-age	% undernourished	Simple screening indicator
	Blood haemoglobin	Annual	Sub-sample	Haemoglobin concentration	% anaemic	General indicator of micronutrient status
	Breastfed	All	All	Exclusive or sustained breastfeeding	% exclusive (0-<6m) or sustained (6-24m) b/f	Indicator of ideal practices
	Vaccinations received	All	All	Vaccinated or not	Access to health services	Vaccination coverage
Children 6-59 months	Number of food groups in food in past 24 h	All	All	Number of food groups	% ≥5 food groups	Indicator of quality of complementary food
Mother of child (15 – 49y)	Weight and height	All	All	Body mass index	% underweight, normal, overweight, obese	Indicator of mother's nutritional status
	Blood haemoglobin	Annual	Sub-sample	Haemoglobin concentration	% anaemic	General indicator of micronutrient status
	Marital status	All	All	Married/unmarried	Polygamy	Female headed households
	Number of children born	All	All	Total fertility		Child mortality
	Number in household	All	All		Dependency ratio	
	Education	All	All		Education level	Enrolment in education
	Occupation of husband	All	All	Socio-economic status	Wealth	Economic indicator
	Iodised salt being used	Annual	All		Risk of iodine deficiency	Coverage of iodised salt
	Child death in last year	All	All		Child mortality	Child mortality
Elderly women ≥60y	Weight and height	All	All	Body mass index	% underweight, normal, overweight, obese	Elderly at risk
	Half arm span	All	All	Body mass armspan	% underweight, normal, overweight, obese	Elderly at risk

Subject	Measurements of data	Surveys	Sample	Indices	Indicators	Value
	MUAC	All	All	Malnutrition	Underweight	Elderly at risk
Children 5-19y	Reported enrolment and class in school	All	All		Enrolment ratio	Educational indicator
	Sex and age	All	All	Age for grade score[24]	Late enrolment	Girls enrolled in school
Household	Cost of diet for average family	All	Sub-sample	Cost of diet;	Cost as % of spending	Cost of purchasing an adequate die to feed a typical family

7. Risks and threats to the success of programmes

There seems to be an underlying fear among people in Pakistan that vaccinations, pills or supplements are being given as a means of applying family planning. For example there have been reports in the press that the oral polio vaccine is being used to sterilise children.[70] This may have been exacerbated recently by the fake campaign to try to obtain DNA samples from the family of Osama bin Laden in Abbottabad using a vaccination programme. The marketing of a micronutrient powder by an agency that promotes contraception may have also acted to link the two health services in people's minds. These issues require that any nutritional product needs careful social marketing using a brand name that is locally specific, in local languages, and with a campaign that promotes the benefits to mothers and children.   An example is marketing of *Annapurna* salt by Unilever in Ghana as a brain food with support from the Ministry of Health and UNICEF. This product, sold in inexpensive 100g packets, has increased the prevalence of iodised salt in households from 28% to more than 50% and has captured 50% of the market.

There is a risk that socially excluded groups in society may be barred from health services for the same reasons.

This review has not been able to assess the capacity of provincial government education or health services to implement the additional programmes suggested here. Teachers can easily be trained to administer simple, occasional treatments to children; Save the Children has substantial experience of this in Pakistan. Although there is a large cadre of potential health workers who are active in villages such as lady health workers, if they are to impart information on new nutritional topics such as complementary feeding and provided with supplements to give to mothers, they will need to be trained. Appropriately trained, they could also be involved in community case management of infections diseases. This requires a mechanism for in-service training, a curriculum, and well-trained trainers to do the training. If there are >100,000 lady health workers in Pakistan then a large number of trainers will be needed. There may need to be investment in developing nutritionists, perhaps to place one in each district, and a mechanism for in-service training of peripheral health staff.

For the same reasons there will need to be investment in developing a cadre of nutritionists in Pakistan. A request for information found that there are BSc and MSc courses in Human Nutrition at the College of Home Economics, Lahore, College of Home Economics, Multan, and Peshawar University. There is an MSc Home Economics at the University of Punjab, Lahore. These course need to be verified. The Aga Khan University in Karachi offers short course in public health nutrition but there is no pure BSc degree in nutrition in Pakistan nor any MSc in Public Health Nutrition, which is a useful specialisation after taking a basic degree in nutrition. There is a need to review these courses, which may well focus on nutritional diseases of affluence, rather than of poverty.

The District Health Management team or its equivalent in Pakistan may also need capacity building. In Ghana, for example, every District Health Officer is required to have a Master's degree in Public Health (MPH), usually obtained overseas, before their appointment.

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[70] http://www.guardian.co.uk/world/2007/feb/15/pakistan.topstories3 Last accessed: 11th August 2011.

8. Conclusions

A very large number of children in Pakistan suffer from undernutrition and perhaps a half of all children less than 5 years old have some combination of stunting, underweight or wasting.

Many of the current or planned programmes supported by DFID, Pakistan could have beneficial nutritional outcomes, although the immediacy of any effects will depend on where they act on the causal pathway to good nutrition.

Programmes that affect the policies and practice of governance could have an influence on the basic causes of malnutrition especially if they affect economic opportunities and food production.

Enrolling girls in school and giving them a good and prolonged education so that they do not get married when they are young and physically immature could have major effects on their risk of dying during child birth and the health and nutritional status of their children. But education does not seem to be enough, alone. Although educated mothers may have children with a lower risk of being stunted or underweight than uneducated mothers (Figure 2), the lack of an association between the level of education and wasting is perplexing and suggests that women's ability to care for their children is impaired, whatever their education. Programmes that have a direct effect on women's ability to care for their children at all levels of society could then have substantial effects. This will however require some profound changes in social attitudes towards females in general, not just legislation to protect women, even if it can be enforced. Although there is no evidence that girls are treated differently from boys when they are breastfed, boys are often better fed than girls and taken for medical care when sick in preference to girls. Such inherent biases need to be tackled throughout the life-cycle, not just during womanhood, and at all levels of society.

Current programmes also offer an opportunity to add some simple new interventions. For example, schools provide an opportunity to reach large numbers of children in very cost-effective ways with health services such as deworming and micronutrient supplements. Health and nutrition education for both sexes can help them become better parents when they have children.

The high prevalence of iodine deficiency and the low proportion of households using iodised table salt should be of great concern, especially as the consequences can be so severe and the solution is so simple. The social marketing of iodised salt and multiple micronutrient supplements containing iodine given to pregnant women or in complementary foods to young children could be important interventions. Multiple micronutrients could help to meet the needs for women and children for all nutrients to ensure healthy growth and development.

Lady Health Workers and Community Midwives provide a widespread, existing mechanism to reach women and children with multiple micronutrient supplements given either as tablets to women during pregnancy and perhaps lactation, or as powders to add to complementary foods for young children.

Appendix 1: Assessing undernutrition

The nutritional status of an individual can be assessed in four main ways:

• By comparing physical (anthropometric) measurements or indices derived from measurements with values for well-nourished individuals of the same sex and age;

• By comparing measurements of the concentration of micronutrients in body fluids with thresholds based on the concentrations associated with good health in well-nourished individuals of the same sex and age;

• By examining individuals for clinical signs of undernutrition or deficiency disease;

• By assessing the quantity and quality of the diet consumed by individuals in terms of energy, protein, fat and carbohydrate (macronutrients), and for vitamins and minerals (micronutrients), in comparison with the recommended intake of individuals of the same sex and age.

The main problem with many forms of undernutrition is that often there are no evident or visible signs: to know if a child is stunted you need to know his or her age, while the signs of anaemia, iodine deficiency and vitamin A deficiency only become apparent when the degree of undernutrition is severe. The only easily recognised sign of undernutrition is wasting or thinness, which is why many people think that malnutrition is due only to a lack of food. As the UNICEF conceptual frameworks shows, it may also be due to infectious diseases and how children are fed and cared for.

Anthropometry, a key measurement in nutrition
Physical anthropometry uses measurements of weight, height (or length[71] of children <2y), mid-upper arm circumference (MUAC) plus age in months to calculate indices based on the difference between the measurement and the distribution of the same value for well-nourished children of the same sex and age. This difference can be measured as a percentile, as a percentage of the median value or, most commonly, in standard deviation units called z-scores. A z-score measures the distance of a value from the average or median value for the well nourished sample, which is set at zero. A negative z-score is less than the median and the more negative the value is, the further a child is from the median. A value of less than -2 z-scores is classified as moderately low because about 95% of healthy well-nourished children should have a value higher than this; a value of less than -3 is classified as severe and less than 0.1% of well nourished children should have a value lower than this. Table 1 shows a summary of the common indices and the age groups that they can be applied to.

As the three main indicators – stunting, underweight and wasting - capture different aspects of anthropometric status, a proportion of all children are counted more than once in each separate percentage. The converse is that the total burden of undernutrition in any population is not captured by any single index. This can be estimated by calculating the proportion of all children who are in each

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[71] Height is measured standing, length is measured supine = lying down, face up

single category, in any two categories or in all three: this is called the composite index of anthropometric failure (CIAF). This is an under-used index that captures the total proportion of undernourished children.

An analysis of 12 data sets on 120,000 children in 9 countries which reported the CIAF shows that in absolute terms and on average about 9% more children (or about 20% in relative terms) show some form of anthropometric failure than the highest prevalence of stunting or underweight, usually the most common form of anthropometric failure. These differences increase linearly with the prevalence of the most common form of anthropometric failure, meaning that the difference is greater the higher the prevalence. The conclusion is that all countries underestimate the prevalence of anthropometric failure by not reporting the CIAF. The CIAF can be estimated with a precision of about ± 2% from the combined prevalences of stunting, underweight and wasting in studies that have reported the CIAF. This report uses an unpublished method to estimate the total number of undernourished children in Pakistan. Access to raw data from surveys in Pakistan, such as the recent DFID/UNICEF survey (see below), could be easily used to calculate the actual CIAF.

Micronutrient deficiencies – hidden hunger
Clinical signs of micronutrient deficiencies only become evident when the body reserves of each micronutrient have been exhausted and the deficiency is severe: pallor caused by anaemia; an enlarged thyroid gland due to an iodine deficiency; dry eyes and Bitot's spots due to a vitamin A deficiency; or beri-beri or pellagra due to deficiencies of B-group vitamins. When such signs are seen, the deficiency is usually widespread and common. For example a prevalence of Bitot's spots on the eyes of more than 0.5% of children suggests that vitamin A deficiency is a major public health problem. Because a survey to estimate a prevalence of 0.5% requires a huge sample size to give a precise estimate, it is a very insensitive method of identifying a problem. For this reason an assessment of the diet is usually done as a proxy estimate of the risks of deficiency.

Measuring the status of iron, vitamin A and zinc in the body requires a sample of blood while a urine specimen is usually analysed to assess iodine status. Blood is difficult to collect and transport to a laboratory, while the analytical methods are complex and expensive, so they are not routine or common procedures. The exception is the haemoglobin concentration of the blood which requires only a drop of blood taken from a finger prick made using a lancet; a single-use cuvette treated with chemicals costing about USD 0.40; and a portable, battery powered machine called a Hemocue costing about USD 400. The concentration of haemoglobin is a useful general indicator of micronutrient status as its manufacture in the bone marrow requires supplies of iron, vitamin A, vitamin B_{12}, folate and vitamin C. This means that the haemoglobin concentration is not simply a measure of iron status as many people assume, and also means that not all anaemia is due to an iron deficiency.

Table 1. The main anthropometric measurements, indices and indicators used to classify undernutrition in children and adults. Values published by the WHO are used to calculate z-scores for each index.

Data (units)	Index	Units	Thresholds	Indicator	Reflects	Children <5y	Children 5-19y	Adults
Weight (kg), height (cm), sex	Weight-for-height	SDs or z-score	<-2, moderate <-3, severe	Wasted[a]	Acute under-nutrition, recent disease or both	Yes	No (see BMI for age)	No
Height (cm), age (months), sex	Height-for-age	SDs or z-score	<-2, moderate <-3, severe	Stunted	Chronic under-nutrition, repeated disease or both	Yes	Yes	No
Weight (kg), age (months), sex	Weight-for-age	SDs or z-score	<-2, moderate <-3, severe	Under-weight	A combination of both stunting and wasting	Yes	Up to 10y only	No
Weight (kg)/ height (m)^2	Body mass index (BMI)[b]	kg/m^2	<16.5, severe <18.5, modern-ate	Thin	Acute under-nutrition, recent disease or both	No	No	Yes
BMI (kg/m^2), age (months), sex	BMI-for age	SDs or z-score	<-2, moderate <-3, severe	Thin for age	Acute under-nutrition, recent disease or both	Yes	Yes	No
Mid upper-arm circumference (MUAC) (mm)	MUAC	mm	<110 children[c] <124 adults	Under-nourished	Acute under-nutrition, recent disease or both	Yes	No	Yes
MUAC (mm), age (months), sex	MUAC-for-age	SDs or z-score	<-2, moderate <-3, severe	Under-nourished	Acute under-nutrition, recent disease or both	Yes	No	No

SD = Standard deviation; MUAC = Mid upper arm circumference; BMI = body mass index
[a] Also called 'global acute malnutrition' (GAM) a non-specific, direct translation from French field jargon and 'severe acute malnutrition' (SAM). The terms wasting and wasted are better as they identify a specific type of undernutrition.
[b] Also used to classify adults as overweight (≥25 kg/m^2) or obese (≥30 kg/m^2)
[c] These are the lower thresholds; others are applied to both young children and adults.

Indicators of nutrition practices

A wide range of nutritional practices are considered to be important for the nutritional status of children and mothers, so are often included in nutrition and health surveys. They include:

- Percentage children <6 months old who are fed breast milk exclusively;

- Percentage of children given adequate complementary foods, usually assessed in terms of the number of meals per day and the number of food groups consumed each day;

- Percentage of households using adequately iodised salt;

- Percentage of children 6m – 5 y who have received a capsule of vitamin A (children aged 6-11 m should get 100,000 international units (IU) every six months and children aged 12-59 months should get 200,000 IU every six months).

- The percentage of children who have received all their vaccinations.

These indicators are used to describe the risk that the diet of young children is inadequate or that the child has poor access to health services that prevent malnutrition or disease.

Appendix 2: A tabular analysis of the possible effects of DFID programmes on nutrition and the likely causal pathway.

Sector	Programme	Intervention and causal pathway	Nutritional outcome
Governance	Gender justice	Empowerment of women to care for their children and themselves	Reduced prevalence of wasting in short term and underweight and stunting in long term; fewer children born with low birth weight
	KPK Provincial Reform	Nutrition as in indicator of effectiveness and improvement	Reduced prevalence of wasting in short term and underweight and stunting in long term
	Border areas	Stability in food supplies, improved food security	Better diet and improved nutritional status
Economic growth	Punjab Economic Opportunities	Income from employment, or food or income from livestock	Better nourished children and women
Education	Punjab Education Sector Support	Health and nutrition education	Pupils children are better nourished
		School health service: deworming	Increased appetite, less malabsorption
		School health service: micronutrients	Improved haemoglobin concentration, growth
	KPK Education Sector Support	Enrolment of girls so access to health education and school health services	Better nourished girls
		Stipend for girls	Spent on food.
	Education Fund for Sindh	Health and nutrition education	Pupils children are better nourished
		School health service: deworming	Increased appetite, less malabsorption
		School health service: micronutrients	Improved haemoglobin concentration, growth
	Innovation fund for education	Enrolling children in school so they have access to health services	Better nourished children
Health	Maternal and newborn health	Micronutrients for pregnant women improve their nutritional status and the quality of their breast milk	Lower risk of miscarriage, dying during child birth; lower risk of low birth weight infant; better nourished breast-fed infant
		Micronutrients for women after delivery	Better nourished breast-fed infant
	Reproductive health and family planning	Delayed first pregnancy	Women more physically able to have baby and better nourished
		Long interval between pregnancies	Better nourished women

Appendix 3: Terms of Reference for a Short Term Consultant to undertake a Nutrition Audit for DFID Pakistan

1. Objective of the Consultancy

- To assess and identify the extent to which current DFID P's activities and programmes already make a contribution to reduction of under nutrition in Pakistan (policy and operations) i.e have a specific nutrition objective or indicator and may be nutrition specific or nutrition sensitive.
- To assess the potential for scaling up DFID P's existing programmes to make a contribution to reduction of under-nutrition in Pakistan through revisions to design and make practical and costed recommendations of how to incorporate potential scaling-up opportunities.
- To assess the feasibility (and estimate the cost/ benefit in nutrition terms) of integrating nutrition outcomes into the design of new DFID P programmes.
- To identify appropriate nutrition indicators (and the source of baseline / monitoring data) that can usefully be integrated into existing programmes
- To build the capacity of different teams in the office on nutrition - raising awareness and building links between the humanitarian and longer term thinking on nutrition.
- To get engaged with the DFID Pakistan teams and think through with them how to strengthen nutritional impact of existing programmes

2. Context

A country with a population of 178 million (the 6th most populous country in the world) and ranking 132 in the world by level of income (GDP per capita $2,789), Pakistan has some of the worst health indicators in the world. It has, for instance:

− The fifth highest maternal deaths in the world (~ 14,000 per year);

− The fourth highest under-five child deaths in the world (~460,000 per year);

− Poor reproductive health. Women average 4 births during their reproductive life (the second highest fertility rate in South Asia after Afghanistan);

− Low contraceptive use (only 30% of married couples use contraception);

The statistics relating to nutrition in Pakistan are shocking, and unless addressed will undermine planned progress in a number of areas such as health and education:

- One in 4 children in Pakistan is born underweight, 40% of under 5's are stunted and 37% underweight – among the highest rates of child malnutrition in the world
- Iodine deficiency in pregnancy causes 2,100,000 babies per year to be born mentally impaired, and 64% of children are iodine deficient, even moderate deficiency reducing IQ by up to 15 points
- In 2008 84,000,000 people had inadequate access to sufficient caloric intake, up by 12,000,000 fro 2005-6.
- Most of the damage caused by malnutrition from the first day of pregnancy to the 2nd year of life is irreversible, and should be considered our key focus for intervention, consistent with DFID's nutrition strategy.

Recent surveys and engagements through DFID's response to the Floods have flagged up the dire status of nutrition in Pakistan.

Through the BAR process and in the Operational Plan DFID P has identified the need for more progress in addressing nutrition. While there are no plans for stand alone nutrition programmes, there are opportunities to increase the nutritional impact of existing and planned interventions.

As well as assisting development of the significant nutrition components of the forthcoming health programme there is considerable scope to make DFID P's overall portfolio more nutrition-sensitive.

3. The recipients:

DFID Pakistan

4. Expected Outputs:
- A brief report summarising DFID's P's portfolio in relation to the nutrition audit conducted as outlined in the above objectives.
- A map of current DFID P's programmes against sectors relevant to nutrition (similar to the example see Appendix 1 produced for DFID India).
- A results framework for current DFID P's programmes covering direct service delivery and indirect approaches (drawn from the UNICEF conceptual framework for nutrition) (see example Appendix 2)
- A feasibility of and estimated (orders of magnitude) cost/ benefit assessment by programme of integrating nutrition outcomes into results frameworks. Also an expected output should include an aggregate figure for the number of under fives which DFID P will reach with nutrition related programmes
- An outline of outputs and findings (solid draft) ready in the last week of the consultant being in-country to enable him/her to make a presentation of their findings to the Office and have a more in-depth discussion with the group heads and programme managers in-country.

5. Methodology

- Meetings with team leaders / advisors / programme managers.
- Short workshops (1-2 hrs) with teams

- Analysis of DFID programme portfolio and Log-frames.
- Meetings with some of DFID Pakistan's key partners - Govt, UN agencies etc.
- VC/Bat phone conversation with Nutrition Team in DFID Palace Street.

6. Timeframe:

Short term consultancy max 4 person weeks (3 weeks in-country and 1 week home desk based).
In the last in-country week of the assignment the consultant will conduct one presentation to the DFID P's Office and hold a more in-depth 1 or 2 sessions with Group heads and programme managers.
Draft report and findings expected in-country and final report expected one week after assignment.

7. Reporting to:

The consultant will be reporting to Vel Gnanendran Deputy Head and Head of Basic Services Group, DFID Pakistan.

The HDRC assignment manager is Jack Eldon. The HDRC is responsible for managing the consultants and for providing quality assurance services.

8. Consultants Specification

The work requires an international development professional with considerable knowledge, skills and experience in nutrition (preferably experience within Pakistan or South Asia).

9. Security

The consultants will be responsible for ensuring their own safety and security. We recommend to consultants that they work within the framework of the British High Commission's (BHC) security advice and follow the DFID process for obtaining security clearance for all travel within Pakistan. DFID will advise on the process should the consultants agree to operate within the BHC's framework.

The BHC and DFID accept no liability for injury, loss or damage arising in any respect of any statement contained within its security advice.

10. Key documents

- How to note: How to write a Business Case
- DFID guidance for new log frame
- Bilateral Aid Review and Multilateral Aid Review
- DFID Pakistan Operational Plan
- DFID Nutrition Strategy.
- Development of Guidance on indicators for monitoring the impact of DFID's nutrition strategy (hdrc – DFID human development resource centre)
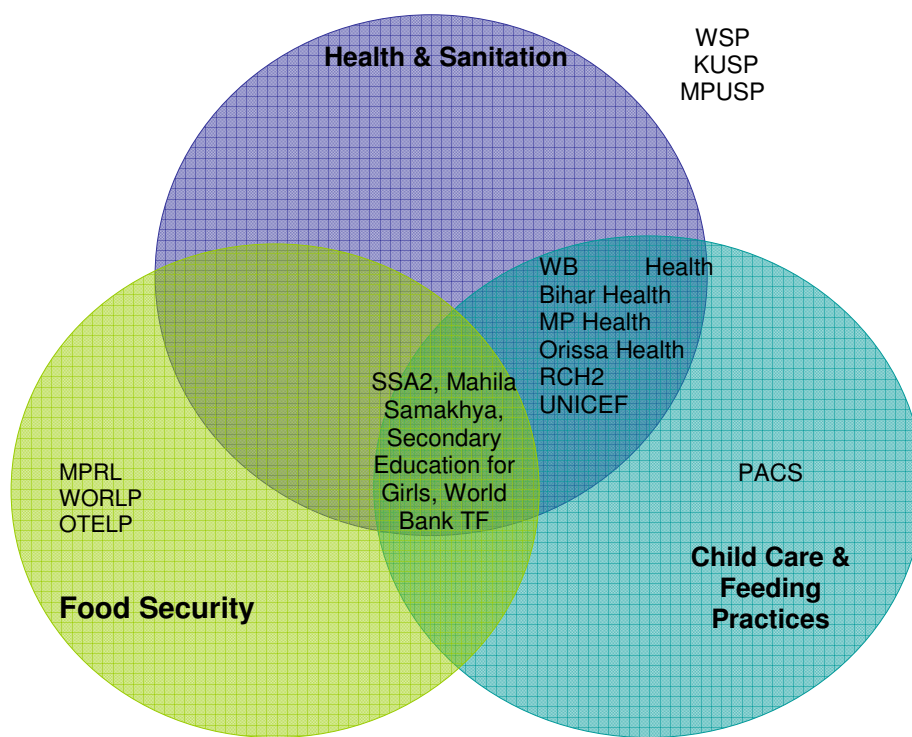- Annex 1-2 Nutrition Audit mapping in DFID India

Annex 1
Multi-sectoral actions in India to achieve nutrition security

Nutrition   Audit   Mapping

Annex 2   Example of nutrition results mapping from DFID India's portfolio.

DFID Global target - Reduce malnutrition – 12 M children globally				
DFID India Contribution – 1.4 million over 4 years				
DFID India's portfolio				
BAR	**Results**	**Which programmes**	**Results indicators**	**Issues, Questions & Evidence generation**
Direct Delivery of MDGs	**DIRECT service delivery**			
	Health	Bihar, MP and Orissa – SBS with MHFW	% reduction in IMR % of children underweight <5 years (between 10-20%) Increase in Breastfeeding and IYCF practises. Maternal Health improvements 3.5 Million children out of malnutrition by 2015 in poorer states	Impact assessments planned (RCTs/pilots/operation research) to measure impact on child malnutrition. Includes fortification, integrated services, CCTs, community mgt SAM
	Feeding Caring Practises	Bihar, MP and Orissa – SBS with DWCD		
	Water and Sanitation	JNNURM SWASTH -Bihar Urban WASH ADB, WB	Proportion of population with sustainable access to safe water Proportion of population with access to sanitation	Bihar- Community level maintenance of water supply Orissa – RCT to determine contribution of water or latrines on underweight Bihar SPUR Eval on sanitation impact on health/diarrhoea
	(Governance for direct delivery)	MP, Orissa, Bihar Health and Nutrition	Strategic level: Increased allocations to nutrition; New institutional mechanism (Nutrition Mission in MP); better planning and monitoring	
	INDIRECT contribution to nutrition			
	Girls Education	SSA RMSA	Increased numbers of girls enrolled, retained and through primary and secondary school	Girls education can contribute up to reduction in malnutrition
	Poverty, Hunger and Vulnerability	Rural livelihoods Agricultural productivity WORLP OTELP MPRLP	WORLP Availability: Increase in yields: paddy 19%, maize 20%, groundnut 30%, cotton 250%, green gram 200%; 67% project households own cattle. MPRLP Access:	Linking RL interventions more explicitly with improvement of nutritional outcomes (in particular for adolescent girls, pregnant women and amongst SC/ST) Better VFM data on relative impact of indirect interventions, internationally, nationally and at state

			46% of poorest households reported an increase in income from wage labour; Lean season food deficit days: 13% fewer households reporting OTELP <u>Utilization:</u> 63.5% households reported access to clean water	level How to ensure improvements in income improve nutrition? MPRLP pilot to include/measure nutrition impacts
Gender	Women's Empowerment and increased equity	Mahila Samakaya	Reduction in women's anaemia	
		PACS – Civil society programme	Proportion of malnourished children in 0-3 years Indicative outcomes - Increase in no of children breast fed (exclusive) during the first six months Increase in timely introduction of complementary feeding (including quality of food)	
	Advocacy	State Hunger Index		IFPRI's inclusion of gender/governance indicators in SHI
	Social transfers			Planned CCTs for nutrition and maternal health improvements pilots in poorer states.
Wealth Creation	Inclusive Growth	Poorest State Inclusive Growth Programme	Malnourishment rate amongst children below 5 years - 35% decrease over control groups since 2010	
Global partnerships	UN	UNICEF	Reduction in malnutrition rates	
	World Bank	ICDS – TA support	Reduction in malnutrition rates through delivery of ICDS	
	SAFANS	Evidence for policy change in South Asia	Reduction in malnutrition rates in South Asia Increased productive dialogue on regional food security	Creating of evidence to impact effectively on India's policy.

Appendix 4: People met in Pakistan, in alphabetical order of last name:

Asim Raza Ahmad, Pakistan Flour Mills Association
Moeen Akhter, DFID
Sikandar Ali, DFID
Asmat, Merlin
Helen Appleton, DFID
Damon Bristow, DFID
Martin Dawson, DFID
Hamish Falconer, DFID
Alexis Ferrand, DFID
Will Guest, DFID
Andrew Durrant, DFID
Daniel Harris, DHA Communication
Sarah Hawkes, DFID
Peter Hawkins, DFID
Ina Ismail, DFID
Neelofar Javaid, DFID
Amanullah Khan, Save the Children
Noor Ahmed Khan, Micronutrient Initiative
Saiqa Kanwal, DFID
Zahid Larik, Children's Hospital
Sarita Neupane, UNICEF
Nighat Nisa, DFID
Dharini Nathwani, DFID
Tom Owen-Edmunds, DFID
Debbie Palmer, DFID
George Petropoulos, ACF
Joanne Simpson, DFID
Mashar Siraj, DFID
Teshome, UNICEF
George Turkington, DFID
Aliya Usmani, DFID
Waqas Ul-Hassan, DFID
Badar Uzaman, Save the Children
Rob Wood, Consultant in Social Marketing
Desmond Whyms, DFID
Raza Zaidi, DFID
Bushra Zulfiquar, DFID

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