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Addressing child undernutrition: evidence review

Office of Development Effectiveness

March 2014

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Abbreviations and acronyms

ACF	Action Contre la Faim
AIDS	acquired immunodeficiency syndrome
CGIAR	formerly the Consultative Group on International Agricultural Research
CIDA	Canadian International Development Agency
DEVCO	Directorate-General for Development and Cooperation
DFID	Department for International Development, United Kingdom
EC	European Commission
ECHO	European Community Humanitarian Office
FAO	Food and Agriculture Organization of the United Nations
GII	Gender Inequality Index
HANCI	Hunger and Nutrition Commitment Index
HDI	Human Development Index
HIV	human immunodeficiency virus
ICBMS	International Code on Breast Milk Substitutes
IDRC	International Development Research Centre
IDS	Institute of Development Studies
IFPRI	International Food Policy Research Institute
JICA	Japan International Cooperation Agency
MDG	Millennium Development Goal
NGO	non-government organisation
ODI	Overseas Development Institute
REACH	Renewed Efforts Against Child Hunger and Undernutrition
SUN	Scaling Up Nutrition
UK	United Kingdom
UN	United Nations
UNICEF	United Nations Children's Fund
UN SCN	United Nations Standing Committee on Nutrition
WFP	World Food Programme
WHO	World Health Organization

Explanation of technical terms

Malnutrition is the condition that develops when the body does not get the correct quantity and balance of the calories, protein, vitamins, minerals and other nutrients it needs to maintain healthy tissues, organ function and, in children and adolescents, adequate growth and development. Malnutrition includes both undernutrition and overnutrition.

Undernutrition is a consequence of consuming too few essential nutrients, or using or excreting them more rapidly than they can be replaced. In children, the outcome is growth (weight or height) faltering and/or specific symptoms and signs of micronutrient deficiency disorders.

Golden has classified undernutrition into type I and type II nutrient deficiencies.¹

Type I nutrient deficiencies

Type I nutrients include iron, calcium, iodine, selenium and all the vitamins. These nutrients, which are stored in the body, are mainly required for specific metabolic functions (biochemical pathways) in the body, rather than for metabolism in general. When a person's diet is deficient in a type I nutrient, the person initially continues to grow normally. The body store of the nutrient is consumed first. The concentration of the nutrient in the tissues then falls until the specific metabolic function that depends on the nutrient declines and the person becomes ill. The illness is recognised by characteristic signs and symptoms; after this stage is reached, growth may or may not be affected secondary to the overt illness.

We consider here the most common deficiencies affecting the health of children—vitamin A, iodine and iron—as well as thiamine deficiency in some Southeast Asian countries.

Type II nutrient deficiencies

Type II nutrients include protein, energy, zinc, magnesium, potassium and sodium. When there is a deficiency in one of the type II or 'growth' nutrients, the person stops growing. The body starts to conserve the nutrient—its excretion falls to very low levels so that there is no reduction in the tissue concentration. With continued or severe deficiency, the body starts to break down its own tissues to release the nutrient for use by the rest of the body; this process is associated with reduced appetite. These nutrients have no body stores that can be called on in an emergency and into which excess nutrients can be deposited.

There are three kinds of type II undernutrition in children: stunting, underweight and wasting.²

Anthropometry is the study of the measurements and proportions of the human body. In nutrition, anthropometry is the measurement of weight and height to estimate indices that are used to diagnose stunting, underweight, wasting and overweight. Anthropometric measurements also include skin fold thickness, and mid-upper arm and head circumference.

Z-scores represent the number of standard deviations by which an individual child's anthropometric index differs from the median of the World Health Organization international growth reference

¹ MHN Golden, Specific deficiencies versus growth failure: type I and type II nutrients. *Journal of Nutritional and Environmental Medicine* 6(3):301–308, 1996.

² United Nations Children's Fund, *Tracking progress on child and maternal nutrition. A survival and development priority*, UNICEF, New York, 2009.

population. This is a database that was developed in 2006 based on breast-fed infants and children less than 5 years of age in Brazil, Ghana, India, Norway, Oman and the United States.

Mid-upper arm circumference (MUAC) can be used to identify acute malnutrition in women and children aged 6–59 months.

Body mass index (BMI, expressed in kg/m²) is an anthropometric measurement commonly used in adults. It is calculated by dividing weight (in kilograms) by the square of height (in metres). Between the ages of 0 and 19 years, BMI-for-age is used.

Stunting is defined as a height-for-age z-score of less than –2. It is due to chronic undernutrition and is associated with impaired growth and intellectual development.

Wasting is defined as a weight-for-height z-score of less than –2 or a MUAC of less than 125 mm. It is due to acute undernutrition. Severe wasting is defined as a weight-for-height z-score of less than –3 or a MUAC of less than 115 mm, and is associated with high mortality from infectious diseases. A child with bilateral oedema—an observable swelling of fluid accumulation in body tissues, most commonly in the feet and legs³—is automatically classified as having severe acute undernutrition.

Underweight is defined as a weight-for-age z-score of less than –2 and is a result of stunting, wasting or both.

Overweight in children is defined as a weight-for-height z score or BMI-for-age z-score of greater than +2. **Obesity** is defined as a weight-for-height z-score or BMI-for-age z-score of greater than +3.

Short stature in adults may be the outcome of stunting in childhood. Short stature refers to an adult who is below the average height for an adult of the same age and sex. In women, a cut-off height of less than 145 cm is commonly used to define short stature.⁴

Low birthweight is defined as a birthweight of less than 2500 g. The two main causes of low birthweight are premature birth and intrauterine growth retardation.

Undernourishment refers to daily dietary energy consumption less than a predetermined threshold. It is measured in terms of the number of kilocalories required to conduct sedentary or light activities. This threshold is country specific. In estimating the rate of undernourishment, the Food and Agriculture Organization of the United Nations (FAO) uses a threshold of 2250 kilocalories per person per day in low- and middle-income countries. The threshold is higher if the average temperature is below 20 °C. **Hunger** is a commonly used synonym for undernourishment.

Food security ‘...exists when all people, at all times, have physical and economic access to sufficient safe and nutritious food that meets their dietary needs and food preferences for an active and healthy

³ World Health Organization and United Nations Children’s Fund, *WHO child growth standards and the identification of severe acute malnutrition in infants and children: a joint statement by the World Health Organization and the United Nations Children’s Fund*, World Health Organization and United Nations Children’s Fund, Geneva, 2009.

⁴ H Rey, E Ortiz, L Fajardo and A Pradilla, Maternal anthropometry: its predictive value for pregnancy outcome. *Bulletin of the World Health Organization* 73(Suppl):70–71, 1995.

life'.⁵ Household food security is the application of this concept at the family level, with individuals within households as the focus of concern.

From this definition, four main dimensions of food security are defined: food availability, access to food, food utilisation and stability of food security.

Physical availability of food addresses the 'supply side' of food security and is determined by the level of food production, stock levels and net trade.

Economic and physical access to food is important because an adequate supply of food at the national or international level does not guarantee household-level food security. Concerns about insufficient food access have resulted in a greater policy focus on incomes, expenditure, markets and prices in achieving food security objectives.

Food utilisation is commonly understood as the way the body makes the most of various nutrients in the food. Sufficient energy and nutrient intake by individuals is the result of good care and feeding practices, food preparation, diversity of the diet and intrahousehold distribution of food. Combined with good biological utilisation of food consumed, this determines the nutritional status of individuals.

Stability of the other three dimensions over time is needed for food security. Even if food intake is adequate today, a person is still considered to be food insecure if they have inadequate access to food on a periodic basis, risking a deterioration of nutritional status. Adverse weather conditions, political instability or economic factors (e.g. unemployment, rising food prices) may have an impact on food security status. For food security objectives to be realised, all four dimensions must be fulfilled simultaneously.

Nutrition security is achieved when secure access to an appropriately nutritious diet is coupled with a sanitary environment, and adequate health services and care, to ensure a healthy and active life for all household members.⁶

Food and nutrition security is a term commonly used by the FAO to emphasise the links between food and nutrition.

Proximal risk factors for undernutrition are those factors that have a direct (or 'immediate') impact on child nutrition. In general, they equate to the food utilisation elements of food security.⁷

Distal risk factors for undernutrition are those factors that have an indirect impact on child nutrition, including the food availability and food access dimensions of food security. Note that our use of the terms 'proximal' and 'distal' are based on the landmark studies of global burden of disease and risk factors.⁸

⁵ Food and Agriculture Organization of the United Nations, *Rome Declaration on World Food Security and World Food Summit Plan of Action*, World Food Summit, 13–17 November 1996, FAO, Rome, 1996.

⁶ Scaling Up Nutrition Road Map Task Team, *A road map for Scaling-Up Nutrition (SUN)*, SUN, 2010.

⁷ AD Lopez, CD Mathers, M Ezzati, DT Jamison and CJL Murray, *Measuring the global burden of disease and risk factors, 1990–2001*, World Bank, Washington, DC, 2006.

⁸ Lopez, Mathers, Ezzati, Jamison and Murray

Nutrition-specific interventions or programs address the proximal risk factors for fetal and child nutrition and development—adequate food and nutrient intake, feeding, care-giving and parenting practices; and low burden of infectious diseases.⁹

Nutrition-sensitive interventions or programs address the distal risk factors for fetal and child nutrition and development—food security; adequate care-giving resources at the maternal, household and community levels; and access to health services, and a safe and hygienic environment. They incorporate specific nutrition goals and action.¹⁰

Nutrition-relevant interventions are those that have an impact on nutrition, including both the preceding categories.

⁹ Maternal and Child Nutrition Study Group, Executive summary of *The Lancet* Maternal and Child Nutrition Series. *Lancet* 2013;1–12, 2013.

¹⁰ Maternal and Child Nutrition Study Group

Introduction

This evidence review provides an overview of current evidence-based approaches to addressing child undernutrition and how they may apply to the Australian aid program.

Part I provides an up-to-date overview of the evidence for the 'proximal' (direct) and 'distal' (indirect) risk factors for child undernutrition, and the effectiveness of tested 'nutrition-specific' (direct) and 'nutrition-sensitive' (indirect) interventions to reduce child undernutrition. Evidence on the cost-effectiveness of these interventions is also included. These terms are explained in the 'Explanation of technical terms' and further elaborated later in this report.

Part II provides an overview of contemporary policy thinking and approaches to addressing childhood undernutrition by development partners, including multilateral organisations, global frameworks and alliances, bilateral donors, and developing country governments. Reference is also made to contemporary nutrition research and programming work by non-government organisations.

Part III summarises data on child nutrition indicators in countries relevant to the Australian aid program. Indicators have been selected to capture type I and type II undernutrition, low birthweight, and the proximal and distal risk factors for child undernutrition. Data for countries most relevant to the Australian aid program are interpreted in supplementary text. Data on overweight and obesity in children are not readily available for most countries of interest to the Australian aid program; however, a global and regional overview is provided.

Part I

Interventions to address child undernutrition

Between one-third and one-half of all deaths in children under 5 years of age are associated with undernutrition.¹¹ New estimates indicate that undernutrition is the aggregate cause of 3.1 million child deaths annually or 45 per cent of all child deaths in 2011.¹² Although each form of type II undernutrition has adverse consequences on the health of infants and young children, stunting leads to probably irreversible developmental outcomes. The proportion of children stunted is often used as an indicator of socioeconomic progress in a population. The second *Lancet* series on maternal and child nutrition, published in June 2013, recommends that stunting should replace underweight as the main anthropometric indicator for estimating undernutrition of children in populations.¹³ Low birthweight is one of the key determinants of child undernutrition, and intrauterine growth retardation is itself a form of undernutrition.

Nutrition is a product of the balance between food intake and utilisation of energy and nutrients; this balance is influenced by disease and mediated by care. The impact of care on nutrition is particularly important during the 1000-day window between conception and 2 years of age.¹⁴ Care is defined as 'the provision in the household and the community of time, attention and support to meet the physical, mental, and social needs of the growing child and other household members'.¹⁵

Nutrition security focuses on the health and nutrition status of the population, including health promotion and disease prevention, aspects of caring practices and health services, and healthy environments. It is achieved by adopting a public health approach, incorporating secure access to sufficient and appropriately nutritious food, a sanitary environment, and adequate health services and care.¹⁶ Therefore, food security is one component of nutrition security; the concept of nutrition security enhances the understanding of how food security influences nutrition, by explicitly linking food, disease and care.¹⁷

¹¹ RE Black, CG Victora, SP Walker, ZA Bhutta, P Christian, M de Onis, M Ezzati, S Grantham-McGregor, J Katz and R Martorell, Maternal and child undernutrition and overweight in low-income and middle-income countries. *Lancet* 382(9890):427–451, 2013.

¹² Black, Victora, Walker, Bhutta, Christian, de Onis, Ezzati, Grantham-McGregor, Katz and Martorell

¹³ Maternal and Child Nutrition Study Group

¹⁴ United Nations Children's Fund, *Improving child nutrition: the achievable imperative for global progress*, UNICEF, New York, 2013.

¹⁵ PL Engle, P Menon and L Haddad, *Care and nutrition: concepts and measurement*, FCND discussion paper 18, International Food Policy Research Institute, Washington, DC, 1996.

¹⁶ Department for International Development, *The neglected crisis of undernutrition: evidence for action*, DFID, London, 2009.

¹⁷ G Le Cuizat and H Mattinen, *Maximising the nutritional impact of food security and livelihoods interventions: a manual for field workers*, ACF International, 2011.

1 Definition of child

The United Nations Convention on the Rights of the Child states that everyone under 18 years of age has all the rights in the convention and can therefore be defined as a child. These rights include ‘the right to good quality health care, clean water, nutritious food and a clean environment so that they will stay healthy’ (Article 24).

However, children aged 0–5 years will be the focus of this evaluation, for two reasons.

- › There are more reliable measures and benchmarks of undernutrition for under-fives than for older age groups.
- › Evidence suggests that undernutrition in the form of stunting is probably irreversible by the child’s fifth birthday, leading to lifelong physical and intellectual impairment.¹⁸

Although nutrition interventions currently focus on the ‘first 1000 days’, from conception to a child’s second birthday, the age at which stunting becomes irreversible varies and may be older than 2 years; consequently, children may benefit from nutrition programs beyond this age.

Other age-related terms used in this document include:

- › infant—a child under the age of 1 year
- › neonate or newborn—an infant under the age of 28 days.

Adolescent girls (aged 11–19 years) warrant attention as a particularly vulnerable group in the nutrition life cycle because, if they become pregnant, they are more likely than adult women to give birth to a low-birthweight baby. Female adolescents have been included in the conceptual framework presented in the second *Lancet* series on nutrition.

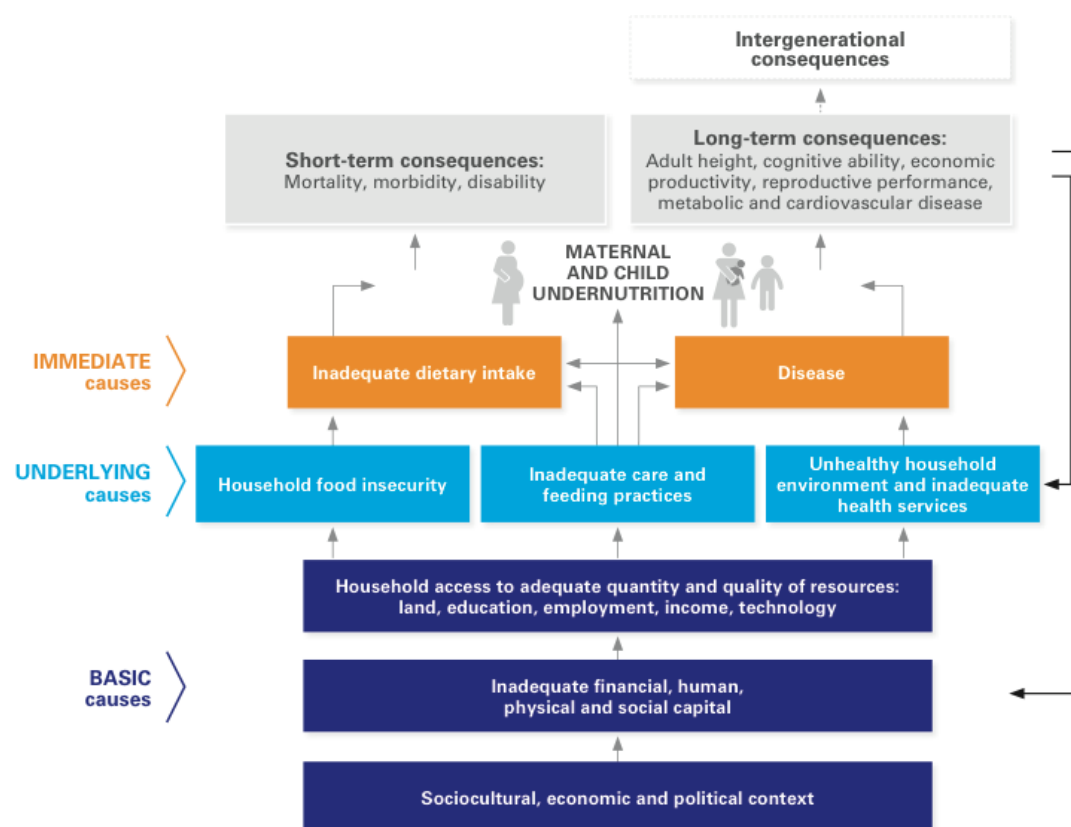
¹⁸ SP Walker, TD Wachs, JM Gardner, B Lozoff, GA Wasserman, E Pollitt, JA Carter and International Child Development Steering Group and, Child development: risk factors for adverse outcomes in developing countries. *Lancet* 369:145–157, 2007.

2 Causal frameworks for undernutrition

A number of frameworks seek to describe the complex range of factors that influence child nutrition. One that is widely cited, and included in the original terms of reference for the evaluation, is the United Nations Children's Fund (UNICEF) framework for improving child nutrition, which was developed 22 years ago.¹⁹ At the core of this framework (Figure 1) are a number of direct determinants of nutrition, called 'immediate' causes, followed by a further group called 'underlying' causes and, at the periphery, a group of 'basic' causes. Basic causes include political, ideological, economic, environmental, resource and technology factors. The UNICEF framework describes 'short-route' interventions that address the immediate causes and 'long-route' interventions that address underlying and basic causes.

¹⁹ M Ruel, Addressing the underlying determinants of undernutrition: examples of successful integration of nutrition in poverty-reduction and agriculture strategies. *UN ACC/SCN News* 36:18–21, 2008.

Figure 1 UNICEF conceptual framework on child undernutrition²⁰



The black arrows show that the consequences of undernutrition can feed back to the underlying and basic causes of undernutrition, perpetuating the cycle of undernutrition, poverty and inequities.

The recently published (2013) *Lancet* series on maternal and child nutrition expanded and refined this framework—for example, by including adolescent girls in the nutrition life cycle.²¹ Rather than the ‘short-route’ and ‘long-route’ interventions described in the UNICEF framework, the *Lancet* series employs the terms ‘nutrition-specific’ and ‘nutrition-sensitive’. We will use the same terms, which are also used by the Scaling Up Nutrition (SUN) Movement. The 2010 SUN Framework for Action outlines the principles and priorities for scaling up global efforts to address undernutrition.²² This framework is supported by a broad coalition of development partners, including Australia.

In conducting the desk-top study, we found that some of the terms used in the UNICEF framework to describe the causes of undernutrition—immediate, underlying, and basic—were imprecise. In particular, the terms ‘underlying’ and ‘basic’ lack specificity. We have opted to use the terminology employed by Murray and Lopez²³ in their landmark studies of the global burden of disease and classify risk factors for child undernutrition as proximal (direct) and distal (indirect).

Murray and Lopez are the world’s pre-eminent experts on the analysis of causal relationships in health and disease. Traditionally, risk factors have been ranked according to the strength of the quantitative relationship between exposure to a risk factor and disease outcomes (the ‘relative risk’).

²⁰ United Nations Children’s Fund, *Improving child nutrition: the achievable imperative for global progress*, UNICEF, New York, 2013.

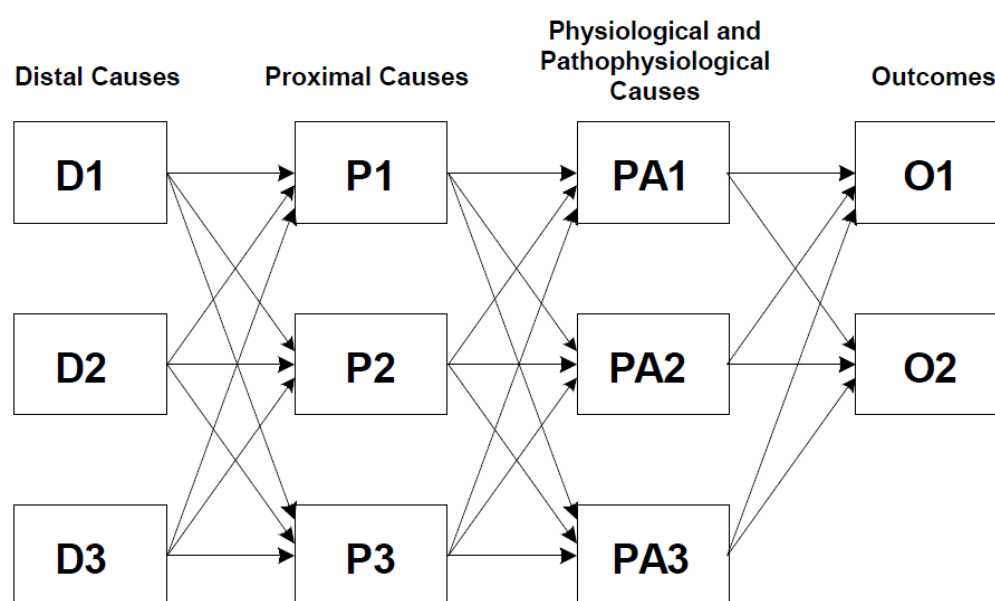
²¹ Maternal and Child Nutrition Study Group

²² United Nations Standing Committee on Nutrition, *Scaling Up Nutrition (SUN)*, SCN, accessed 11 July 2013, www.unscn.org/en/scaling_up_nutrition_sun.

²³ Lopez, Mathers, Ezzati, Jamison and Murray

In 1999, Murray and Lopez described a simplified 'causal-web', which includes the various distal (such as socioeconomic), proximal (behavioural or environmental), and physiological and pathophysiological causes of disease (Figure 2). It should be noted that child undernutrition is very rarely caused by intrinsic pathophysiological factors, such as metabolic disorders. Nutrition-specific interventions address proximal risk factors (or 'causes'), and nutrition-sensitive interventions address distal risk factors.²⁴

Figure 2 Simplified schema for a causal-web illustrating various levels of disease causation (after Murray and Lopez²⁵)



Geographic variation

The risk factors for child undernutrition are significantly different in south Asia, and to some degree in east Asia and the Pacific, from those in sub-Saharan Africa. Through the other components of this evaluation, we will assess whether nutrition-relevant activities of Australian aid address these differences through evidence-based interventions.

Although inadequate access to the minimal level of dietary energy consumption is one major cause of undernutrition, the association is not exclusive at a population level. The highest rates of undernourishment, or hunger, are in sub-Saharan Africa; rates are lower in south and east Asia. However, rates of child undernutrition are high in south and Southeast Asia, demonstrating that factors other than inadequate access to food influence undernutrition.²⁶

The high rates of child undernutrition in south Asia (the so-called 'Asian Enigma') may be due to higher rates of maternal undernutrition than in sub-Saharan Africa, which may in turn be due to

²⁴ CJL Murray and AD Lopez, On the comparable quantification of health risks: lessons from the global burden of disease. *Epidemiology* 10:594–605, 1999.

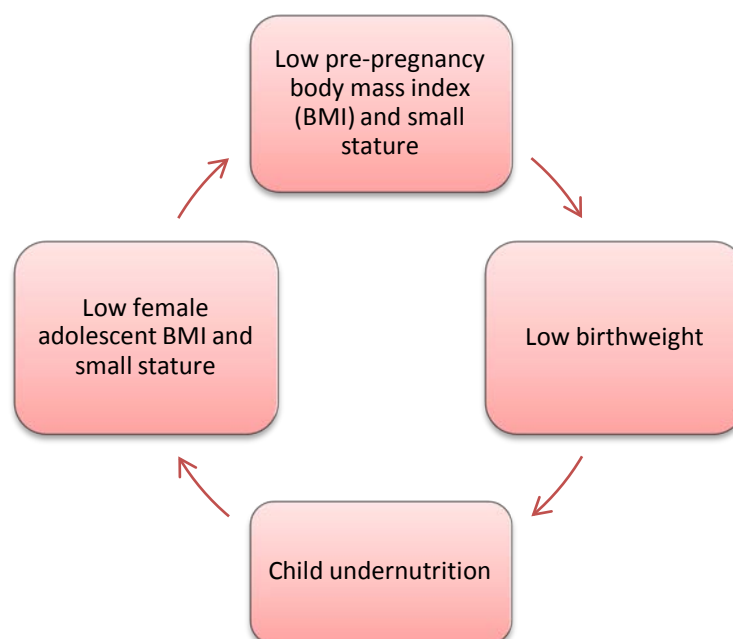
²⁵ Murray and Lopez

²⁶ V Ramalingaswami, U Jonnson and J Rohde, Commentary: the Asian enigma. In: *The progress of nations 1996*, UNICEF, New York, 1996.

differentially poor intrahousehold access by women and girls to food.²⁷ This is discussed in some detail in Section 4.

To address the purpose of this evaluation, it is necessary to explore the relationship between various proximal and distal risk factors and undernutrition, and the interventions that address those risk factors, as part of the conceptual framework. Of key relationships that determine the nutritional status of an infant and young child, one of the most compelling is the intergenerational effect on nutrition (Figure 3).

Figure 3 Intergenerational influences on child nutrition



Small adult women (<145 cm in height) are more likely to have low-birthweight babies, in part because maternal size has an important influence on birthweight. Children born with a low birthweight are more likely to have growth failure during childhood. As a result, girls born with a low birthweight are more likely to become adult women with small stature.²⁸

This cycle is accentuated by teenage pregnancy. As many as half of adolescent girls in some countries are stunted, increasing the risk of complications in pregnancy and delivery, and of poor fetal growth. Cultural beliefs may also play a significant role in determining the diets of pregnant and lactating women, infants and young children. Traditional, sometimes harmful, food taboos are common in many societies during pregnancy, lactation, infancy and illness.²⁹

²⁷ Ramalingaswami, Jonnson and Rohde

²⁸ Black, Victora, Walker, Bhutta, Christian, de Onis, Ezzati, Grantham-McGregor, Katz and Martorell

²⁹ W Holmes, D Hoy, A Lockley, K Thammavongxay, S Bounnaphol, A Xeuvatvongsa and M Toole, Influences on maternal and child nutrition in the highlands of northern Lao PDR. *Asia Pacific Journal of Clinical Nutrition* 16(3):538–546, 2007.

3 Framework of interventions for child undernutrition

In June 2013, *The Lancet* published a second series of papers on maternal and child nutrition. Paper 1, 'Maternal and child undernutrition and overweight in low-income and middle-income countries', acknowledges the shortfalls of the United Nations Children's Fund (UNICEF) 1991 conceptual framework in describing only the immediate, underlying and basic causes of undernutrition and not the means to address the causes.³⁰ The series presents an adapted conceptual framework that incorporates nutrition-specific and nutrition-sensitive interventions to address the immediate, underlying and basic causes of undernutrition, as shown in Figure 4.³¹ Full definitions for nutrition terms used in this section can be found in the 'Explanation of technical terms'.

Paper 2 of the 2013 *Lancet* series on maternal and child nutrition, 'Evidence-based interventions for improvement of maternal and child nutrition: what can be done and at what cost?', includes nutrition-specific interventions to improve nutrition across the life cycle for adolescent girls, women of reproductive age, pregnant women, newborn babies, infants and children.³² We have adopted this framework, with some modifications, as the basis of nutrition-specific interventions.

Nutrition-sensitive interventions have an indirect impact on child nutrition status, by acting on the distal risk factors for child undernutrition, as shown in the scoping framework for child undernutrition used in this review (Figure 5). The distal risk factors for child undernutrition are complex and encompass multiple sectors. Consequently, many nutrition-sensitive interventions are often pre-existing development interventions, such as macroeconomic development and improved primary health care services, that are adjusted to more cogently address nutrition as one of many outcomes.³³

The package of 10 core nutrition-specific interventions outlined in the 2013 *Lancet* series, if scaled up to 90 per cent coverage, may reduce stunting in children under 5 years of age by one-fifth (20.3 per cent).³⁴ To address child undernutrition fully, nutrition-sensitive interventions must also be employed.³⁵ Indeed, improvements in child undernutrition typically reflect a combination of nutrition-

³⁰ Black, Victora, Walker, Bhutta, Christian, de Onis, Ezzati, Grantham-McGregor, Katz and Martorell

³¹ Maternal and Child Nutrition Study Group

³² ZA Bhutta, JK Das, A Rizvi, MF Gaffey, N Walker, S Horton, P Webb, A Lartey and RE Black, Evidence-based interventions for improvement of maternal and child nutrition: what can be done and at what cost? *Lancet* 382(9890):452–477, 2013.

³³ Department for International Development, *An update of 'The neglected crisis of undernutrition: evidence for action'*, DFID, London, 2012.

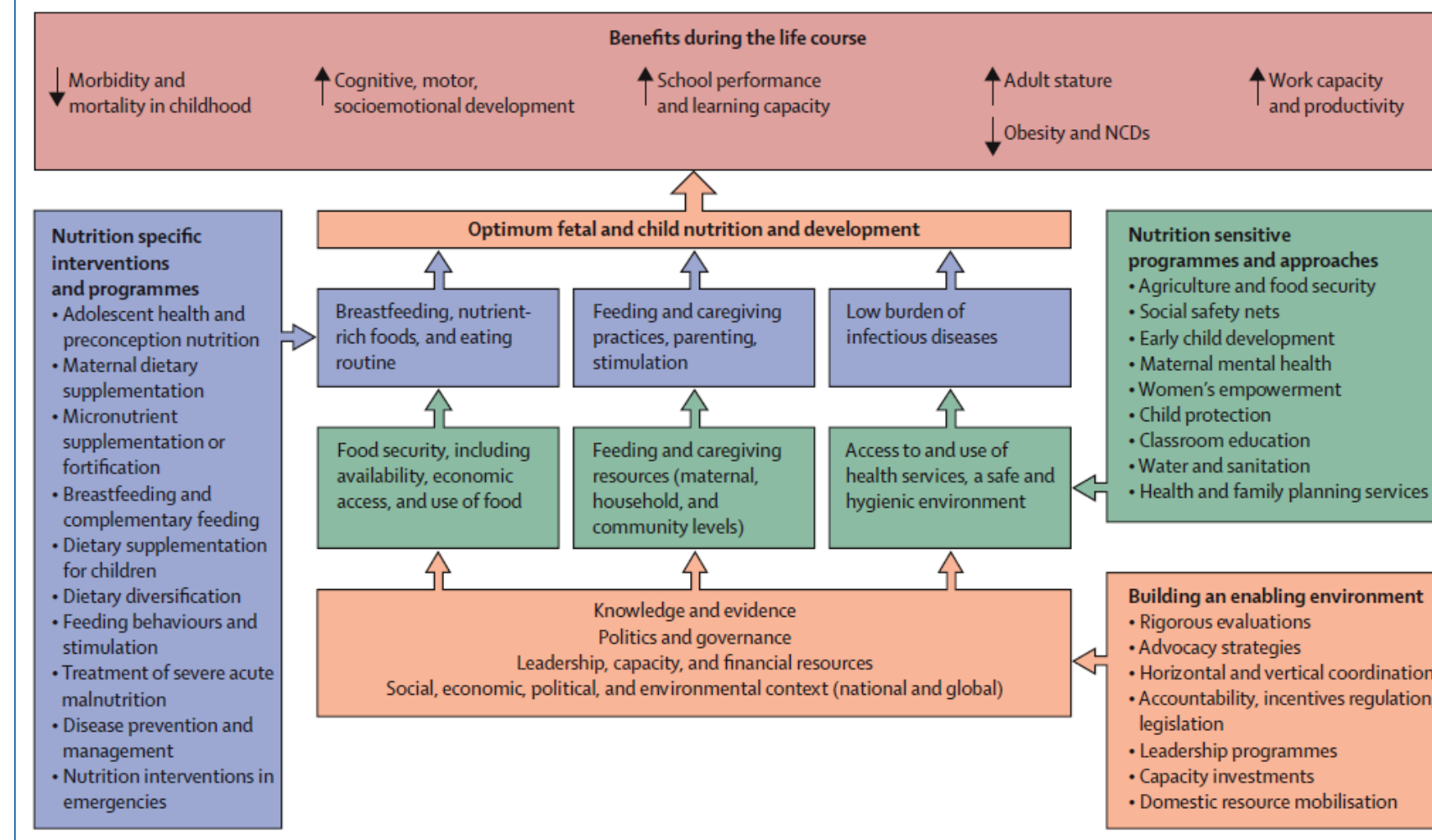
³⁴ Bhutta, Das, Rizvi, Gaffey, Walker, Horton, Webb, Lartey and Black

³⁵ Department for International Development, *The neglected crisis of undernutrition: evidence for action*

specific and nutrition-sensitive interventions.³⁶ This is sometimes called a ‘twin-track’ or ‘multiphase’ approach.

³⁶ R Marcus, P Pereznieto, E Cullen and P Carter, *Progress in child well-being: building on what works*, Save the Children, London, 2012.

Figure 4 Framework for actions to achieve optimum fetal and child nutrition and development (Black et al.³⁷)



³⁷ Black, Victora, Walker, Bhutta, Christian, de Onis, Ezzati, Grantham-McGregor, Katz and Martorell

Figure 5 summarises the nutrition-specific and nutrition-sensitive interventions to reduce child undernutrition that will be the focus of this evaluation. This scoping framework reflects several aims:

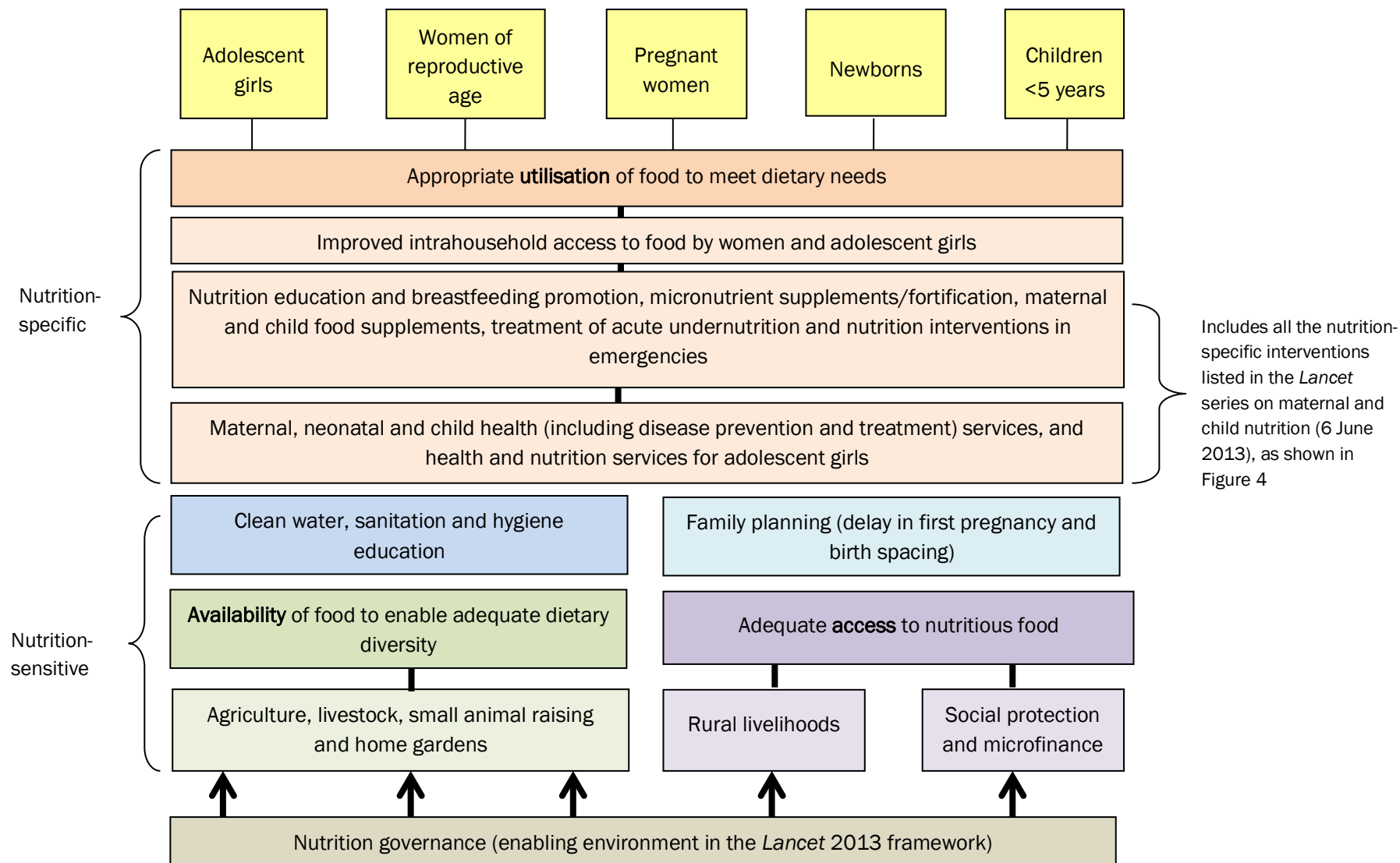
- › to incorporate nutrition within the context of food security
- › to emphasise the life-cycle nature of nutritional influences
- › to acknowledge the most recent evidence for cost-effective nutrition-specific interventions
- › to position improving access by women and adolescent girls to food within the household as a key nutrition-specific intervention.

The scoping framework includes all of the nutrition-specific interventions from the *Lancet* series (listed in the left-hand box of Figure 4) under broad headings. There is an additional intervention—‘improved intrahousehold access to food by women and adolescent girls’—because of the strong evidence of its causal relationship to child undernutrition, especially in south Asia.³⁸

The nutrition-sensitive interventions in the *Lancet* series, such as women’s empowerment, social safety nets, child protection, classroom education and women’s mental health, are not included in the review because Australian aid programs in these sectors do not have measured nutrition outcomes. Interventions that address contributing factors, such as poverty, female illiteracy, weak governance and poor infrastructure, are not included for the same reason.

³⁸ Ramalingaswami, Jonnson and Rohde

Figure 5 Scoping framework of nutrition-specific and nutrition-sensitive interventions for child undernutrition in the context of the three elements of food security



Intervention

For the purposes of this report, a nutrition intervention is an action that has a significant body of evidence demonstrating its impact on child undernutrition. Interventions included in the review are those that have been identified through existing, recent syntheses of the evidence, and for which available evidence indicates a significant³⁹ impact on child undernutrition.

Nutrition-specific interventions or programs address the proximal risk factors for fetal and child nutrition and development—adequate food and nutrient intake, feeding, care-giving and parenting practices; and low burden of infectious diseases.⁴⁰

Nutrition-sensitive interventions or programs address the distal risk factors for fetal and child nutrition and development — food security; adequate care-giving resources at the maternal, household and community levels; and access to health services, and a safe and hygienic environment. They incorporate specific nutrition goals and actions.⁴¹

³⁹ 'Significant' refers to the statistical validity of the findings of field trials that demonstrate a reduction in undernutrition associated with the tested intervention.

⁴⁰ Maternal and Child Nutrition Study Group

⁴¹ Maternal and Child Nutrition Study Group

4 Evidence on the risk factors for child undernutrition

Proximal risk factors

As discussed above, child nutrition status is an outcome of the balance between food intake and food requirements, which is influenced by disease and care. Inadequate energy and nutrient intake, infectious disease and inadequate care are thus the proximal risk factors for child undernutrition.

Inadequate energy and nutrient intake

Inadequate energy or nutrient intake leads directly to child undernutrition. Specifically, chronic energy and/or nutrient depletion in young children leads to slowed skeletal growth and a loss of, or failure to accumulate, muscle mass and fat.⁴² Deficiencies of specific nutrients, including vitamin A, iron, iodine, zinc and thiamine, are also directly associated with increased risk of morbidity and mortality in infants and young children.⁴³

- › Vitamin A deficiency may lead to blindness and is also directly associated with increased risk of death before the age of 5 years.
- › Iron deficiency is associated with anaemia and increased severity of infectious diseases, such as malaria.
- › Iodine deficiency is associated with goitre and cretinism; this is a condition of severely stunted physical and mental growth.
- › Zinc deficiency is associated with impaired growth and increased mortality associated with diarrhoea.
- › Thiamine deficiency is associated with infantile beriberi, which may prove fatal by causing cardiac failure.

Infectious disease

There is a strong correlation between infectious diseases (including diarrhoea, acute respiratory infections, malaria and measles) and undernutrition in children. Infectious diseases negatively affect child nutrition status, with the impact proportional to the severity of infection.⁴⁴

Infectious diseases can lead directly to child undernutrition in four ways.

⁴² J Hoddinott, M Rosegrant and M Torero, *Hunger and malnutrition: investments to reduce hunger and undernutrition*, paper prepared for 2012 Global Copenhagen Consensus, International Food Policy Research Institute, Washington, DC, 2012.

⁴³ Hoddinott, Rosegrant and Torero

⁴⁴ World Bank, *Environmental health and child survival: epidemiology, economics and experience*, World Bank, Washington, DC, 2008.

- › Infections can increase a child's energy or nutrient requirements, making it difficult for them to consume sufficient food. For example, human immunodeficiency virus (HIV)-positive children have 50–100 per cent greater energy requirements than their HIV-negative counterparts because of the increased energy required to combat opportunistic infections.⁴⁵
- › Infections common in low-income settings can reduce the capacity of a child's body to absorb energy or nutrients from food. Intestinal helminth (worm) infestations can lead to malabsorption, and helminth infection in early childhood has been associated with a growth shortfall of 4.6 cm at 7 years of age.⁴⁶ Similarly, diarrhoea is strongly linked with growth faltering;⁴⁷ a study in Brazil found recurring diarrhoea episodes in young children to be associated with a 3.6 cm growth shortfall at 7 years of age.⁴⁸
- › Infections including helminths⁴⁹ and HIV⁵⁰ can directly reduce food consumption by reducing appetite. Symptoms such as vomiting, abdominal pain and dry mouth can also decrease the capacity or desire of children to eat. Furthermore, disease can lead to centrally controlled appetite suppression through the release of the cytokine interleukin-1, which is secreted by certain cells of the immune system in response to infection.
- › Parents often withhold food and fluids from sick children in the belief that this will assist their recovery from illness; this can lead to undernutrition through restricted food intake.

Cycle between energy/nutrient intake and infectious disease

As discussed above, infectious diseases can increase the risk of undernutrition in children. Significantly, however, child undernutrition can also increase the risk of infectious disease.⁵¹ Undernutrition weakens the immune system, placing a child at greater risk of contracting an infectious disease and of experiencing more severe or prolonged illness due to disease.⁵²

As a result, there is a 'synergistic' relationship between undernutrition and infectious disease,⁵³ as shown in Figure 6. The risk of death in children aged under 5 years increases manyfold as their undernutrition status becomes more severe.⁵⁴

⁴⁵ UNAIDS, *HIV, food security and nutrition*, Policy brief, 2008.

⁴⁶ S Moore, Early childhood diarrhoea and helminthiases associated with long-term linear growth faltering. *International Journal of Epidemiology* 30:1457–1464, 2001.

⁴⁷ W Checkley, G Buckley, R Gilman, A Assis, R Guerrant, S Morris, K Mølbak, P Valentiner-Branth, C Lanata, R Black and Childhood Malnutrition and Infection Network, Multi-country analysis of the effects of diarrhoea on childhood stunting. *International Journal of Epidemiology* 37(4):816–830, 2008.

⁴⁸ Moore

⁴⁹ L Stephenson, M Latham and E Ottesen, Malnutrition and parasitic helminth infections. *Parasitology* 121:S23–S38., 2000.

⁵⁰ Department for International Development, *The neglected crisis of undernutrition: evidence for action*

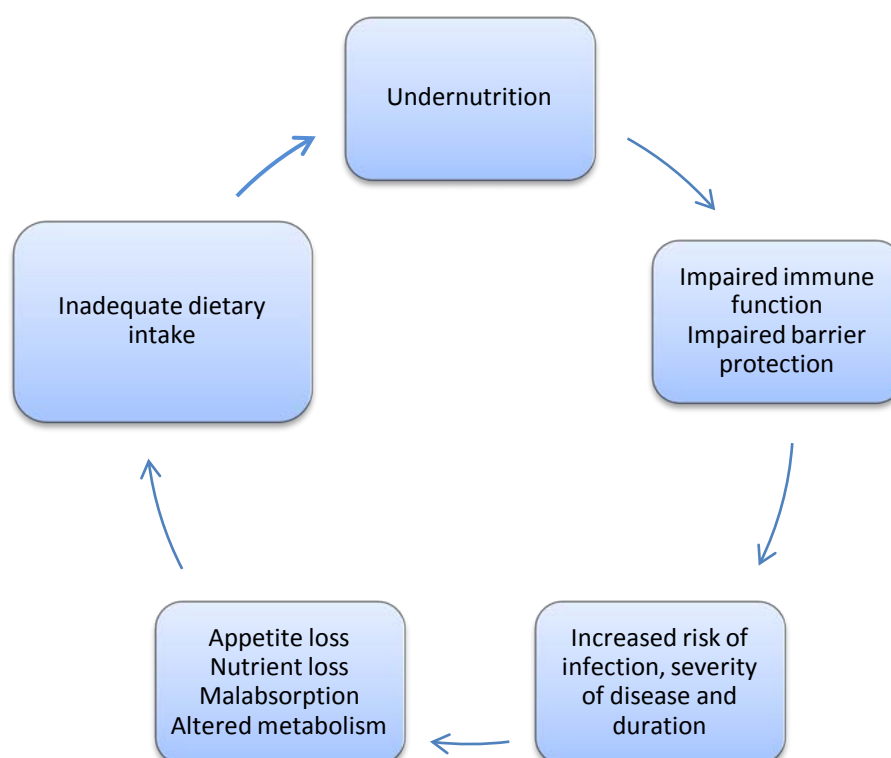
⁵¹ K Brown, Diarrhoea and malnutrition. *Journal of Nutrition* 133:328–332, 2003.

⁵² United Nations Children's Fund, *Improving child nutrition: the achievable imperative for global progress*

⁵³ Department for International Development, *The neglected crisis of undernutrition: evidence for action*

⁵⁴ D Pelletier, EA Frongillo Jr, DG Schroeder and JP Habicht, A methodology for estimating the contribution of malnutrition to child mortality in developing countries. *Journal of Nutrition* 124(10 Suppl):2106S–2122S, 1994.

Figure 6 Vicious cycle between undernutrition and infectious disease



Inadequate care and feeding practices, including health care seeking behaviours

As technical understanding of child nutrition has improved and the critical importance of good nutrition in the first 1000 days (from conception to the child's second birthday) has been identified, the role of inadequate care as a cause of child undernutrition has received greater attention.⁵⁵ Because of the dependent status of infants and young children (under 2 years of age), food intake and disease are very strongly influenced by the feeding, care-giving, and health care-seeking practices of the caregiver. As a result, it is not conceptually meaningful to separate, for example, food intake from feeding practices.⁵⁶

Inappropriate infant and young child feeding practices have a negative impact on child nutrition status. The World Health Organization recommends breastfeeding initiation within 1 hour of birth, exclusive breastfeeding for the first 6 months, and appropriate complementary feeding beginning at 6 months, with breastfeeding continued for 2 years and beyond.⁵⁷ Where these practices are not followed, negative impacts on child nutrition and health can result. A study in Ghana found that 22 per cent of neonatal deaths could have been averted through early initiation of breastfeeding within the first hour of birth.⁵⁸ Infants aged less than 6 months who are not exclusively breastfed are

⁵⁵ United Nations Children's Fund, *Improving child nutrition: the achievable imperative for global progress*

⁵⁶ Department for International Development, *The neglected crisis of undernutrition: evidence for action*

⁵⁷ World Health Organization, *e-Library of evidence for nutrition actions (eLENA)*, WHO, Geneva, 2013, www.who.int/elena/titles/en/.

⁵⁸ Department for International Development, *The neglected crisis of undernutrition: evidence for action*

15 times more likely to die from pneumonia and 11 times more likely to die from diarrhoea than infants who are exclusively breastfed to 6 months of age.⁵⁹

The health care-seeking practices of caregivers are key to whether or not infants and young children are protected from the harmful impacts of infectious diseases on nutrition status.⁶⁰ In Sri Lanka, high rates of health care seeking have been associated with low child mortality in a setting with a high prevalence of child undernutrition; this suggests that appropriate health care seeking can reduce the risks of illness and death associated with undernutrition.⁶¹ Conversely, poor health care seeking has been implicated in 60–70 per cent of child deaths across diverse settings.⁶² One study found that children whose caregivers seek health care in a timely way are 19.5 times less likely to die than children whose caregivers do not seek timely care.⁶³

Inequitable intrahousehold food allocation

It is difficult to measure gender disparities in access to food within the household.⁶⁴ Available evidence, however, indicates that inequitable intrahousehold allocation of food between girl and boy children, and women and men, is a major contributing factor to child undernutrition, particularly in south Asia. Given the large absolute numbers of women and children affected by undernutrition in south Asia, inequitable intrahousehold food allocation can be considered a leading proximal cause of child undernutrition at a global level.

In some rural areas of India, there is evidence that the food intake of girl children is consistently of lower quality and/or quantity than that of male children in the same household.⁶⁵ The inequitable allocation of food between boy and girl children within the household has been recognised by the UNICEF Regional Office for South Asia as sufficiently prevalent to justify the development of advocacy tools targeting this specific issue.⁶⁶

Inequitable intrahousehold allocation of food also affects adult women. It has been reported that the food intake of adult women in south Asia is routinely of lower quality and/or quantity than that of adult men and boy children within the same household.⁶⁷ This has been associated with high rates of

⁵⁹ RE Black, LH Allen, ZA Bhutta, LE Caulfield, M de Onis, M Ezzati, C Mathers and J Rivera, Maternal and child undernutrition: global and regional exposures and health consequences. *Lancet* 371:243–260, 2008.

⁶⁰ ZA Bhutta, T Ahmed, RE Black, S Cousens, K Dewey, E Giugliani, BA Haider, B Kirkwood, S Morris, H Sachdev and M Shekar, What works? Interventions for maternal and child undernutrition and survival. *Lancet* 371:417–440, 2008.

⁶¹ M Amarasiri de Silva, A Wijekoon, R Hornik and J Martines, Care seeking in Sri Lanka: one possible explanation for low childhood mortality. *Social Science & Medicine* 53(10):1363–1372, 2001.

⁶² Z Hill, B Kirkwood and K Edmond, *Family and community practices that promote child survival, growth and development: a review of the evidence*, World Health Organization, Geneva, 2004.

⁶³ H Reyes, H Guiscafré, O Muñoz, R Pérez-Cuevas, H Martinez and G Gutiérrez, Antibiotic noncompliance and waste in upper respiratory infections and acute diarrhea. *Journal of Clinical Epidemiology* 50(11):1297–1304, 1997.

⁶⁴ Department for International Development, *The neglected crisis of undernutrition: evidence for action*

⁶⁵ M Dasgupta, Selective discrimination against female children in rural Punjab, India. *Population and Development Review* 13(1):77–100, 1987.

⁶⁶ United Nations Children's Fund Regional Office for South Asia, *Dividing the mango*, Meena 3, UNICEF ROSA, Nepal, 2002.

⁶⁷ Ramalingaswami, Jonnson and Rohde

anaemia in adult women, particularly during pregnancy; as discussed later in this section, this has an intergenerational effect, leading to low birthweight and child undernutrition.⁶⁸

Inadequate maternal, neonatal and child health services

As discussed above, care seeking can have a protective effect on child health and survival outcomes associated with nutrition status. However, health care seeking can only have an impact if quality care is available. There is, therefore, an association between the quality and accessibility of maternal, neonatal and child health services and child nutrition status.⁶⁹

In Colombia⁷⁰ and Ghana,⁷¹ improvements in the quality and accessibility of health services led to substantial improvements in child nutrition status. A cross-country review of successful community-based primary health care services found that they led to an average fall in the prevalence of child underweight of 1–2 per cent per year.⁷²

Furthermore, where quality care exists but is not accessible to all children, those children unable to access care are more likely to experience undernutrition. In India, for example, ‘institutional discrimination’ in health services and among nutrition workers, which excluded children from socially marginalised groups from accessing care, contributed to a substantially higher prevalence of underweight in children within these groups.⁷³

Distal risk factors

Distal factors at the household level place children at risk of inadequate food intake, disease, and inadequate care and feeding practices.

⁶⁸ Ramalingaswami, Jonnson and Rohde

⁶⁹ World Bank, *Repositioning nutrition as central to development: a strategy for large-scale action*, Directions in Development, World Bank, Washington, DC, 2006.

JB Mason, D Sanders, PS Musgrove and R Galloway, Community health and nutrition programs. In: *Disease control priorities in developing countries*, D Jamison, J Breman, A Measham, G Alleyne, M Claeson, D Evans, P Jha, A Mills and P Musgrove (eds), 2nd edition, World Bank, Washington, DC, 2006.

P Mosquera, J Hernández, R Vega, J Martinez, R Labonte, D Sanders and M San Sebastián, The impact of primary healthcare in reducing inequalities in child health outcomes, Bogotá Colombia: an ecological analysis. *International Journal for Equity in Health* 13(11):66, 2012.

M Saaka and S Galaa, Improving the utilization of health and nutrition services: experience from the Catholic Relief Services supported the Development Assistance Programme in Ghana. *Primary Health Care Research & Development* 12(2):146–156, 2011.

⁷⁰ Mosquera, Hernández, Vega, Martinez, Labonte, Sanders and San Sebastián

⁷¹ Saaka and Galaa

⁷² World Bank, *Repositioning nutrition as central to development: a strategy for large-scale action*; Mason, Sanders, Musgrove and Galloway, Community health and nutrition programs

⁷³ Department for International Development, *The neglected crisis of undernutrition: evidence for action*

Unhealthy household environment—water, sanitation and hygiene

A lack of access to safe water, adequate sanitation facilities and basic hygiene practices results in exposure to repeated water-related diseases, including enteric and helminth infections.⁷⁴ Exposure to these diseases in early childhood is associated with stunting.⁷⁵ As well, a substantial proportion of wasting in children is caused by acute and chronic diarrhoea that is attributable to inadequate water, sanitation and hygiene practices.⁷⁶

It is estimated that 50 per cent of the total disease burden of undernutrition is attributable to environmental factors, including inadequate water, sanitation and hygiene practices.⁷⁷

Inadequate access to food

Reliable access of households to food has a complex relationship with nutrition, and it is difficult to measure the impact of inadequate household access to food on child undernutrition.⁷⁸ However, available evidence indicates that household food insufficiency negatively affects nutrition by restricting food intake.

A multicountry study in Myanmar, Ethiopia, Bangladesh and Tanzania found that the minimum cost of a healthy diet⁷⁹ is beyond the means of most poor households, indicating that the required quality or quantity of food is not being consumed in these households.⁸⁰ Most of the undernourishment globally is attributable to household food insecurity, since it results from the inability of households to access sufficient food during the annual ‘hungry season’, when food stocks are at their lowest preceding the harvest season.⁸¹

Low agricultural productivity

There are strong conceptual linkages between agricultural development and child nutrition, but the evidence to support causal pathways is challenging to develop.⁸² As a basic principle, low agricultural

⁷⁴ Stephenson, Latham and Ottesen; Department for International Development, *The neglected crisis of undernutrition: evidence for action*

⁷⁵ A Prüss-Ustün and C Corvalán, *Preventing disease through healthy environments: towards an estimate of the environmental burden of disease*, World Bank Environmental burden of disease series 12, World Health Organization, Geneva, 2006.

⁷⁶ Department for International Development, *The neglected crisis of undernutrition: evidence for action*

⁷⁷ Prüss-Ustün and Corvalán

⁷⁸ Department for International Development, *The neglected crisis of undernutrition: evidence for action*

⁷⁹ A healthy diet includes at least the minimum daily requirements of each essential unit as defined by the World Health Organization. It includes at least an average of 2250 kilocalories (averaged across all ages).

⁸⁰ C Chastre, A Duffield, H Kindness, S LeJeune and A Taylor, *The minimum cost of a healthy diet: findings from piloting a new methodology in four study locations*, Save the Children, 2007.

⁸¹ S Devereux, B Vaitla and S Hauenstein Swan, *Seasons of hunger: fighting cycles of quiet starvation among the world’s rural poor*, ACF-IN, London, 2008.

⁸² Department for International Development, *An update of ‘The neglected crisis of undernutrition: evidence for action’*; MT Ruel and H Alderman, Nutrition-sensitive interventions and programmes: how can they help to accelerate progress in improving maternal and child nutrition? *Lancet* 382(9891):536–551, 2013.

productivity among rural subsistence farmers is understood to lead to child undernutrition by restricting the quantity and/or quality of food intake⁸³ and generating household food insecurity.⁸⁴

Evidence supports the association between agricultural productivity and diet quantity and quality. Where agricultural growth has an impact on food availability, increased agricultural productivity generally increases the quantity of food consumed.⁸⁵ However, where increased agricultural productivity is achieved through mono-crop production or increased production of nutrient-poor foods, productivity increases do not have a strong correlation with improved child nutrition outcomes.⁸⁶ The likely explanation for this observed association is that mono-cropping and the production of nutrient-poor foods do not directly increase the accessibility of nutrients to children, and therefore may be less likely to avert micronutrient deficiencies.⁸⁷

Available evidence indicates a strong relationship between agricultural productivity and household food sufficiency. A multicountry study found a robust association between agricultural productivity and poverty, such that a 1 per cent increase in agricultural yields reduces the percentage of a country's population living on less than \$1 per day by 0.64–0.91 per cent.⁸⁸ Thus, low agricultural productivity can be expected to restrict the financial capacity of households to access food. Additionally, where agricultural yields are insufficient to provide adequate food throughout the year, a hungry season occurs among food producers and groups within the rural economy who rely on producers for their livelihood; this season is associated with substantial acute undernutrition in children.⁸⁹

Low status of women

There is a strong and well-established correlation between the status of women and child nutrition status in developing countries.⁹⁰ Based on data from 36 developing countries, it is estimated that the regional prevalence in south Asia of underweight in children aged under 3 years would drop by 13 per cent if men and women had equal status; for sub-Saharan Africa, where existing gender disparities

⁸³ World Bank, *From agriculture to nutrition: pathways, synergies and outcomes*, World Bank, Washington, DC, 2007.

⁸⁴ E Masset, L Haddad, A Cornelius and J Isanza-Castro, *A systematic review of agricultural interventions that aim to improve the nutritional status of children*, EPPI-Centre, Social Science Research Unit, Institute of Education, University of London, 2011.

⁸⁵ D Headey. Turning economic growth into nutrition-sensitive growth. Paper presented at the 2020 Conference: leveraging agriculture for improving nutrition and health, New Delhi, India, 10–12 February 2011.

⁸⁶ Canadian International Development Agency, *Towards a healthy, well nourished world: making the links between agriculture, nutrition, health and the environment*, CIDA, Ottawa, 2000.
G Arroyave, Agricultural and food policies: some concerns regarding their nutritional relevance. *Archivos Latinoamericanos de Nutrición* 45:12–18, 1995.

⁸⁷ Arroyave

⁸⁸ C Thirtle, L Beyers, L Lin, V McKenzie-Hill, X Irz, S Wiggins and J Piesse, *The impact of changes in agricultural productivity on the incidence of poverty in developing countries*, Department for International Development, London and East Kilbride, 2002.

⁸⁹ Devereux, Vaitla and Hauenstein Swan

⁹⁰ L Smith, U Ramakrishnan, A Ndiaye, L Haddad and R Martorell, *The importance of women's status for child nutrition in developing countries*, International Food Policy and Research Institute, Washington, DC, 2003.

are generally less sharp, the estimated effect is nearly 3 per cent.⁹¹ Nationally representative data from Bangladesh show that age at first marriage, maternal height, maternal educational attainment and attitudes towards domestic violence are closely correlated with child stunting.⁹²

One key explanation for the impact of women's status on child nutrition is the role of women as caregivers. Women are almost always the primary caregivers for infants and young children in developing countries, and as such are closely involved with the quality of feeding, exposure to disease, and care of infants and young children— three of the proximal risk factors for child undernutrition.⁹³ Consequently, undernutrition can result where women lack the capacity to support child nutrition.

For example, where women have greater workloads than men, they have less time to provide quality care for children, including optimal feeding practices;⁹⁴ as discussed above, inadequate care and feeding practices impact negatively on child nutrition.⁹⁵ Social stressors on mothers, such as poverty, violence and heavy workloads, can increase undernutrition in their children.⁹⁶ Additionally, where women have little control over how resources are allocated within the household, resources are less likely to be allocated to children's nutrition and health.⁹⁷ Furthermore, inability of women to access and control the use of resources for their own wellbeing has a significant negative impact on the nutrition and health of their children.⁹⁸

The low status of women is associated with early childbearing. Adolescent girls are more likely to have underweight babies, who then are at higher risk of undernutrition in childhood.⁹⁹

Women's low status is also associated with poor maternal nutrition both before and during pregnancy; as discussed below, this has negative impacts on child nutrition. Poor maternal nutrition is a particular concern in south Asia, as demonstrated by the lower weight gain during pregnancy and

⁹¹ Smith, Ramakrishnan, Ndiaye, Haddad and Martorell

⁹² P Bhagowalia, P Menon, AR Quisumbing and V Soundararajan, *What dimensions of women's empowerment matter most for child nutrition? Evidence using nationally representative data from Bangladesh*, IFPRI discussion paper 01192, International Food Policy Research Institute, Washington, DC, 2012.

⁹³ Department for International Development, *The neglected crisis of undernutrition: evidence for action*

⁹⁴ United Nations Children's Fund and Liverpool School of Tropical Medicine, *Gender influences on child survival, health and nutrition: a narrative review*, UNICEF and Liverpool School of Tropical Medicine, New York, 2011.

⁹⁵ H Bouis and J Hunt, Linking food and nutrition security: past lessons and future opportunities. *Asian Development Review* 17(1/2):168–213, 1999.

⁹⁶ SP Walker, TD Wachs, S Grantham-McGregor, MM Black, CA Nelson, SL Huffman, H Baker-Henningham, SM Chang, JD Hamadani, B Lozoff, JM Meeks Gardner, CA Powell, A Rahman and L Richter, Inequality in early childhood: risk and protective factors for early child development. *Lancet* 378(9799):1328–1344.

⁹⁷ United Nations Children's Fund and Liverpool School of Tropical Medicine, *Gender influences on child survival, health and nutrition: a narrative review*

⁹⁸ United Nations Children's Fund and Liverpool School of Tropical Medicine, *Gender influences on child survival, health and nutrition: a narrative review*

⁹⁹ CM Gibbs, A Wendt, S Peters and CJ Hogue, The impact of early age at first childbirth on maternal and infant health. *Paediatric and Perinatal Epidemiology* 26(S1):259–284, 2012.

higher rates of low birthweight in south Asia compared with sub-Saharan Africa.¹⁰⁰ The intergenerational effects of poor maternal nutrition are discussed below.

Evidence for the effects of women's status on child undernutrition emerges most strongly from south Asian settings, particularly for poor maternal nutrition outcomes. This is likely to reflect the generally larger inequities in the status of women and men in south Asian settings than in other regions, providing a larger effect that is more easily measured. This interpretation is supported by the results of a multicountry analysis including the regions of south Asia, sub-Saharan Africa, and Latin America and the Caribbean, which found an association at a regional level between the magnitude of the impact of women's low status on child nutrition and the degree of status inequality between men and women.¹⁰¹

Contributing factors at the household level

Values, beliefs, strategies and trade-offs within individual households can mediate the impact of risk factors on household members' nutrition.¹⁰²

For example, the impact of household food insufficiency on child nutrition is mediated by intrahousehold decisions about the allocation of food and feeding practices for young children. Studies have shown that these can have negative¹⁰³ or positive¹⁰⁴ impacts on child nutrition status. Decisions about care seeking for children are also typically made through intrahousehold bargaining processes, and are therefore influenced by the prevailing values and beliefs of household members.¹⁰⁵

Cultural beliefs may play a significant role in determining the diets of pregnant and lactating women, infants and young children. Traditional food taboos are common in some societies and are passed on from generation to generation. A study of eight minority ethnic groups in two remote northern provinces of the Lao People's Democratic Republic found that certain nutrition behaviours, including food taboos, may contribute to the high prevalence of child malnutrition and micronutrient deficiencies. Ethnic groups gave details of nutrition-related beliefs and practices; many of these are likely to be amenable to change through relatively low-cost nutrition promotion informed by the study's findings.¹⁰⁶

Contributing factors at the societal level

Certain factors at the societal level place households at risk of exposure to the proximal and distal causes of child undernutrition.

¹⁰⁰ Ramalingaswami, Jonnson and Rohde

¹⁰¹ Smith, Ramakrishnan, Ndiaye, Haddad and Martorell

¹⁰² Le Cuizat and Mattinen

¹⁰³ Dasgupta

¹⁰⁴ U Mackintosh, D Marsh and D Schroeder, Sustained positive deviant child care practices and their effects on child growth in Viet Nam. *Food and Nutrition Bulletin* 23(4 (Suppl)):18–27, 2002.

¹⁰⁵ United Nations Children's Fund and Liverpool School of Tropical Medicine, *Gender influences on child survival, health and nutrition: a narrative review*; Hill, Kirkwood and Edmond, *Family and community practices that promote child survival, growth and development: a review of the evidence*

¹⁰⁶ Holmes, Hoy, Lockley, Thammavongxay, Bounnaphol, Xeuatvongsa and Toole

Poverty and inequity

At the national level, poverty is strongly associated with child undernutrition. Countries with high proportions of their populations living in poverty have substantially higher levels of child undernutrition.¹⁰⁷

Inequitable distribution of wealth also influences child undernutrition within national populations. A review of 50 developing countries found that severe stunting in children is almost three times higher among the poorest wealth quintile (18.0 per cent) than among the richest wealth quintile (6.2 per cent).¹⁰⁸

Poverty places direct constraints on households' ability to access food and health services, and provide care in the immediate term.¹⁰⁹ Evidence indicates that poverty also has longer-term impacts on child nutrition by severely limiting households' capacity to make investments with positive nutritional impacts. For example, a study in south India found that poor rural households typically select low-risk, low-return crops rather than investing in high-risk, high-return crops, because they do not have the financial reserves to manage the higher risk of low yields in the short term.¹¹⁰ As described above, household food insufficiency is a strong, if distal, causal factor for child undernutrition.

Poverty and undernutrition are mutually reinforcing. It is well established that a high prevalence of undernutrition constrains economic activity by individuals and economic growth at a national level,¹¹¹ creating a vicious cycle between poverty and undernutrition at the national and household level.

Weak governance

Governance can be expected to affect child nutrition status because it is central to several key domains that influence nutrition: the provision of public goods and services, including water and sanitation; the level of equity in access to health and education services by the poor; multiple inputs to the status of women; and the design and degree of social protection.¹¹²

Numerous recent studies have found a correlation between governance and child nutrition status. A robust multivariate analysis of 82 countries found a correlation between lower rates of child undernutrition and higher levels of government effectiveness, political stability and rule of law.¹¹³ An in-depth study of governance and child undernutrition in Madagascar found that political commitment, accountability, demand for nutrition and nutrition governance, and effective financing

¹⁰⁷ Headey

¹⁰⁸ R Gwatkin, S Rutstein, K Johnson, E Suliman, A Wagstaff and A Amouzou, *Socio-economic differences in health, nutrition and population within developing countries: an overview*, Country reports on HNP and poverty, World Bank, Washington, DC, 2007.

¹⁰⁹ Chastre, Duffield, Kindness, LeJeune and Taylor

¹¹⁰ M Rosenzweig and H Binswanger, Wealth, weather risk and the composition and profitability of agricultural investments. *Economic Journal* 103(416):56–78, 1993.

¹¹¹ Department for International Development, *The neglected crisis of undernutrition: evidence for action*

¹¹² Food and Agriculture Organization of the United Nations, *The state of food insecurity in the world: economic growth is necessary but not sufficient to accelerate reduction of hunger and malnutrition*, FAO, Rome, 2012.

¹¹³ C Rokx, *Governance and malnutrition: exploring the contribution of 'good governance' to malnutrition reduction in developing countries*, Febo Druk, The Netherlands, 2006.

led to substantial reductions in child undernutrition.¹¹⁴ Two separate studies comparing several in-depth country case studies found that governance structures, funding and political will have been key to effective action on nutrition.¹¹⁵

Contributing factors at the institutional level

Formal and informal institutions, such as markets and social protection mechanisms, moderate the impact of the causal factors on households and individuals. Undernutrition often results from ‘vulnerability to shocks and long term stresses’.¹¹⁶ Institutions can support households and individuals to prevent and cope with these shocks and stresses.¹¹⁷

Amartya Sen’s seminal research on famine in India found that an absence of institutional mechanisms to facilitate access to food led to mass hunger, since there was no legal means to cope with the basic risk factors for undernutrition.¹¹⁸ Conversely, market adjustments in Namibia to increase the purchasing power of pensioners and provide incentives for trading in rural or disadvantaged areas have had a positive impact on household nutrition.¹¹⁹ In Malawi, changes to the design and management of the national grain reserve have been linked with price spikes and a major famine,¹²⁰ while a subsequent government subsidy program for selected agricultural inputs has been linked with large, rapid declines in staple cereal prices and a decline in the prevalence of child undernutrition.¹²¹ The case of Malawi demonstrates the substantial mediating influence of institutions on the relationship between underlying poverty and low agricultural productivity and nutrition.

Intergenerational effects of poor maternal nutrition and health

The causal and contributing factors described above operate in the context of intergenerational effects of maternal undernutrition.

¹¹⁴ Rokx

¹¹⁵ L Haddad, AM Acosta and J Fanzo, *Accelerating reductions in undernutrition: what can nutrition governance tell us?*, In Focus Policy Briefing 22, Institute of Development Studies, Brighton, 2012. Sullivan, Lort-Phillips and Tinoco, Zero hunger: transforming evidence-based success into effective change

¹¹⁶ Le Cuizat and Mattinen

¹¹⁷ United Nations Development Programme, *Exploring the role of social protection in enhancing food security in Africa*, Issue brief, United Nations Development Programme, New York, 2011.

¹¹⁸ United Nations Development Programme, *Exploring the role of social protection in enhancing food security in Africa*

¹¹⁹ S Devereux, Can social safety nets reduce chronic poverty? *Development Policy Review* 20(5):657 – 675, 2002.

¹²⁰ High Level Panel of Experts, *Social protection for food security: a report by the High Level Panel of Experts on Food Security and Nutrition*, HLPE report 4, Committee on World Food Security, Rome, 2012.

¹²¹ G Denning, P Kabambe, P Sanchez, A Malik, R Flor, R Harawa, P Nkhoma, C Zamba, C Banda, C Magombo, M Keating, J Wangila and J Sachs, Input subsidies to improve smallholder maize productivity in Malawi: toward an African green revolution. *PLoS Biology* 7(1):doi:10.1371/journal.pbio.1000023, 2009.

The nutritional status of a woman before and during pregnancy directly affects the health of her baby.¹²² This is in addition to the indirect impact on child nutrition of the woman's capacity to provide quality infant care (discussed above).

Maternal ill health during pregnancy can lead directly to low birthweight. In particular, maternal malaria infection during pregnancy has a strong association with low birthweight.¹²³

Poor child or adolescent nutrition results in stunting or thinness in adulthood.¹²⁴ Thin women or women of short stature are more likely to have babies with a low birthweight.¹²⁵ This establishes a cyclical relationship between maternal undernutrition and low birthweight (see Figure 3 in Section 2).

Inadequate maternal energy intake is associated with child undernutrition. Low maternal body mass index before pregnancy is associated with intrauterine growth restriction, which leads to low birthweight and stunting.¹²⁶ Maternal undernutrition during pregnancy is also associated with energy and nutrient deficiencies for the child during pregnancy;¹²⁷ this leads to poor fetal growth, which can lead to stunting in childhood.¹²⁸

Inadequate maternal nutrient intake is also associated with child undernutrition. Maternal anaemia is a predisposing factor for low birthweight in children,¹²⁹ as demonstrated by studies in India and Pakistan.¹³⁰ Additionally, the concentration of micronutrients, including vitamin A and iodine, in breastmilk is contingent on maternal nutrient status and intake; maternal deficiencies in these nutrients are very likely to lead to infant depletion and deficiencies.¹³¹ This is particularly relevant for vitamin A deficiency in children, since neonates have low stores of this nutrient. Maternal nutrient

¹²² Black, Allen, Bhutta, Caulfield, de Onis, Ezzati, Mathers and Rivera

¹²³ H Guyatt and R Snow, Impact of malaria during pregnancy on low birth weight in sub-Saharan Africa. *Clinical Microbiology Reviews* 17(4):760–769, 2004.

¹²⁴ United Nations Children's Fund, *Improving child nutrition: the achievable imperative for global progress*

¹²⁵ Department for International Development, *An update of 'The neglected crisis of undernutrition: evidence for action'*; E Özaltin, K Hill and S Subramanian, Association of maternal stature with offspring mortality, underweight, and stunting in low- to middle-income countries. *JAMA* 303(15):1507–1516, 2010.

¹²⁶ S Fishman, L Caulfield, M de Onis, M Blössner, A Hyder, L Mullany and R Black, Childhood and maternal underweight. In: *Comparative quantification of health risks: global and regional burden of disease attributable to selected major risk factors*, M Ezzati, A Lopez, A Rodgers and C Murray (eds), World Health Organization, Geneva, 2004, 39–161.

¹²⁷ N Thomas, L Grunnet, P Poulsen, S Christopher, R Spurgeon, M Inbakumari, R Livingstone, R Alex, V Mohan, B Antonisamy, F Geethanjali, R Karol, A Vaag and I Bygbjerg, Born with low birth weight in rural Southern India: what are the metabolic consequences 20 years later? *European Journal of Endocrinology* 166:647–655, 2012.

V Nobili, A Alisi, N Panera and C Agostoni, Low birth weight and catch-up-growth associated with metabolic syndrome: a ten year systematic review. *Pediatric Endocrinology Reviews* 6(2):241–247, 2008.

¹²⁸ C Victoria, L Adair, C Fall, P Hallal, R Martorell, L Richter and H Singh Sachdev, Maternal and child undernutrition: consequences for adult health and human capital. *Lancet* 371(9609):302, 2008.

¹²⁹ Department for International Development, *The neglected crisis of undernutrition: evidence for action*

¹³⁰ N Ramachandran, *Women and food security in South Asia*, World Institute for Development Economics Research, United Nations University, Helsinki, 2006.

¹³¹ Black, Allen, Bhutta, Caulfield, de Onis, Ezzati, Mathers and Rivera

deficiencies can be caused or exacerbated by short intervals between pregnancies as well as by poor nutrition.¹³²

¹³² United Nations Children's Fund, *Improving child nutrition: the achievable imperative for global progress*

5 Recent evidence on the benefits and cost-effectiveness of nutrition-specific and nutrition-sensitive interventions

Nutrition-specific interventions targeting type II nutrient deficiencies

Nutrition-specific interventions directly target nutrition outcomes, by acting on the proximal risk factors for child undernutrition. They include interventions targeting mothers during or after pregnancy that directly affect child nutrition status.

Nutrition-specific interventions are best targeted to the 1000-day 'window of opportunity' covering pregnancy and the first 2 years of life, since this provides the best chance of reversing the impact of stunting and cognitive impairment.¹³³

Table 1 summarises the strength of evidence for nutrition-specific interventions targeting type II deficiencies, according to the *Lancet* 2013 series.

¹³³ Department for International Development, *An update of 'The neglected crisis of undernutrition: evidence for action'*

Table 1 Summary: strength of evidence for nutrition-specific interventions targeting type II deficiencies, according to the *Lancet* 2013 series

Intervention	Evidence for impact on child undernutrition ^a
Promotion of early and exclusive breastfeeding in infants	Strong
Promotion of appropriate complementary feeding in children 6–24 months	Strong
Growth monitoring	Weak
Therapeutic zinc supplements for diarrhoea management	Weak; strong evidence of indirect impact through reduced diarrhoea morbidity
Routine preventive zinc supplements in young children	Moderate
Deworming drugs for children	Strong (for children with confirmed infection only)
Prevention or treatment of moderate acute undernutrition in non-emergency settings	Moderate
Community-based management of severe acute undernutrition with ready-to-use therapeutic foods in non-emergency settings	Strong
Facility-based management of severe acute undernutrition according to WHO protocol in non-emergency settings	Strong
Balanced energy and protein supplements during pregnancy	Strong
Deworming during pregnancy	Weak
Maternal education on infant and young child feeding, and child care	Weak; strong evidence of impact when delivered as part of a comprehensive approach
Special populations: malaria prevention and intermittent treatment during pregnancy in endemic areas—reduces low birthweight	Strong

WHO = World Health Organization

^a These classifications are based exclusively on the 2013 *Lancet* series on maternal and child nutrition and include only interventions assessed as having an impact on child undernutrition. Evidence is discussed more broadly in the text, with additional references provided. Some potential interventions not included in the *Lancet* series are also discussed in the text.

Promotion of early and exclusive breastfeeding

Definition: putting the infant to the breast within 1 hour of birth, and breastfeeding exclusively for the first 6 months of life—that is, the infant receives only breastmilk, with no other liquids or solids (including water), with the exception of oral rehydration salts or liquid vitamins, minerals or medicines.¹³⁴ A child should be breastfed until at least 2 years of age.

Breastmilk, including colostrum, almost always provides the optimal quality and quantity of nutrients and antibodies for infants; its ingestion therefore supports child nutrition.¹³⁵ Early initiation of breastfeeding can protect neonates from acquiring infections,¹³⁶ and is an important part of establishing successful breastfeeding. Exclusive breastfeeding is also associated with lower rates of gastrointestinal infection in infants.¹³⁷ Given the role of disease, particularly enteric infections, as a proximal risk factor for child undernutrition, exclusive breastfeeding therefore has a positive impact on child nutrition status.

¹³⁴ World Health Organization, *e-Library of evidence for nutrition actions (eLENA)*

¹³⁵ World Health Organization, *e-Library of evidence for nutrition actions (eLENA)*

¹³⁶ Department for International Development, *The neglected crisis of undernutrition: evidence for action*

¹³⁷ MS Kramer and R Kakuma, Optimal duration of exclusive breastfeeding. *Cochrane Database of Systematic Reviews* 82012.

Evidence for the impact of interventions to support early initiation of, and exclusive, breastfeeding has recently been updated in a systematic review of more than 100 studies.¹³⁸ This review found that counselling or educational interventions increase the rates of exclusive breastfeeding in the first day after birth by 43 per cent, in the first month after birth by 30 per cent, and in 1–6 months after birth by 90 per cent.¹³⁹ Counselling or educational interventions have also been associated with declines in the rates of not breastfeeding in the first day after birth by 32 per cent, in the first month after birth by 30 per cent, and in 1–6 months after birth by 18 per cent.¹⁴⁰ Combined individual and group counselling was found to be more effective than either individual or group counselling on its own.¹⁴¹

Promotion of appropriate complementary feeding

Definition: the introduction of safe, nutritionally adequate foods at 6 months of age, along with breastmilk.

Children aged 6–24 months have high nutrient needs relative to energy intake—foods need to be particularly nutrient rich and contain an appropriate balance of specific nutrients to support optimal growth and cognitive development.¹⁴² Growth faltering, associated with the consumption of foods of low nutrient density, is most evident during this period.¹⁴³

A systematic review of interventions across 25 countries found no single best model for promoting complementary feeding, since feeding practices are highly culture and context specific.¹⁴⁴ Interventions must therefore be carefully designed with reference to the target population to ensure that they are feasible, relevant and appropriate. For example, educational interventions in isolation have been demonstrated to reduce stunting in food-secure populations, whereas educational interventions are most effective in food-insecure populations when combined with food supplements.¹⁴⁵

Growth monitoring

Definition: routine measurements in children less than 5 years of age to detect abnormal growth, combined with some action when abnormal growth is detected.¹⁴⁶

The 2008 *Lancet* series on maternal and child nutrition suggested that growth monitoring may be effective as a platform to deliver nutrition counselling and referrals for children identified as affected by undernutrition,¹⁴⁷ but that there is insufficient evidence for a direct impact of stand-alone growth

¹³⁸ S Haroon, JK Das, RA Salam and ZA Bhutta, Breastfeeding promotion interventions and breastfeeding practices: a systematic review. *BMC Public Health* 13(Suppl 3):S20, 2013.

Bhutta, Das, Rizvi, Gaffey, Walker, Horton, Webb, Lartey and Black

¹³⁹ Bhutta, Das, Rizvi, Gaffey, Walker, Horton, Webb, Lartey and Black

¹⁴⁰ Bhutta, Das, Rizvi, Gaffey, Walker, Horton, Webb, Lartey and Black

¹⁴¹ Bhutta, Das, Rizvi, Gaffey, Walker, Horton, Webb, Lartey and Black

¹⁴² KG Dewey and S Adu-Afarwuah, Systematic review of the efficacy and effectiveness of complementary feeding interventions in developing countries. *Maternal & Child Nutrition* 4:24–85, 2008.

¹⁴³ Dewey and Adu-Afarwuah

¹⁴⁴ Dewey and Adu-Afarwuah

¹⁴⁵ Bhutta, Ahmed, Black, Cousens, Dewey, Giugliani, Haider, Kirkwood, Morris, Sachdev and Shekar

¹⁴⁶ R Panpanich and P Garner, Growth monitoring in children. *Cochrane Database of Systematic Reviews* 1:doi:10.1002/14651858.CD14001443, 2009.

¹⁴⁷ Bhutta, Ahmed, Black, Cousens, Dewey, Giugliani, Haider, Kirkwood, Morris, Sachdev and Shekar

monitoring on child undernutrition.¹⁴⁸ The 2013 *Lancet* series does not refer to growth monitoring. A Cochrane review updated in 2009 found no difference in nutritional status between children who receive growth monitoring and those who do not; however, the review included only one study, which may have had too little statistical power to detect a difference between intervention and control groups.¹⁴⁹ A systematic review including multiple studies from eight countries in south Asia, Africa and the Caribbean found evidence that children who receive growth monitoring in tandem with access to child health services and maternal nutrition education have better nutrition and survival outcomes than children who do not receive this integrated growth monitoring intervention.¹⁵⁰

Therapeutic zinc¹⁵¹ supplements for diarrhoea management

Definition: zinc supplementation during diarrhoea episodes (20 mg per day for 10–14 days).

There is good evidence that therapeutic zinc supplementation can reduce the duration of acute diarrhoea by 0.5 days, and of persistent diarrhoea by 0.68 days.¹⁵² This is expected to protect children from the negative impact of diarrhoea on nutrition status. However, a Cochrane review found insufficient evidence for the impact of therapeutic zinc supplementation on death or hospitalisation.¹⁵³

Routine preventive zinc supplements in young children

Definition: zinc supplementation provided daily or weekly to children less than 5 years of age.

Preventive zinc supplementation may reduce the prevalence of diarrhoea at a population level in a population at risk of zinc deficiency.¹⁵⁴ This would be expected to have a positive impact on child nutrition. However, the evidence for impact of routine zinc supplementation on nutrition is currently ambiguous. A 2009 meta-analysis of 40 trials found only weak evidence for the impact of routine zinc

¹⁴⁸ J Bryce, D Coitinho, I Darnton-Hill, D Pelletier, P Pinstrup-Andersen and Maternal and Child Undernutrition Study Group, Maternal and child undernutrition: effective action at national level. *Lancet* 371:510–526, 2008.

¹⁴⁹ Panpanich and Garner

¹⁵⁰ A Ashworth, R Shrimpton and K Jamil, Growth monitoring and promotion: review of evidence of impact. *Maternal & Child Nutrition* 4:86–117, 2008.

¹⁵¹ Zinc is considered a type II nutrient, along with energy, amino acids, sodium and potassium, whereas vitamins, iron, iodine, folate and calcium are considered type I nutrients (see M Golden, The nature of nutritional deficiency in relation to growth failure and poverty. *Acta Paediatrica Scandinavica* 374:95–110, 1991.).

¹⁵² B Haider and Z Bhutta, The effect of therapeutic zinc supplementation among young children with selected infections: a review of the evidence. *Food and Nutrition Bulletin* 30(1):S41–S59, 2009.

¹⁵³ M Lazzarini and L Ronfani, Oral zinc for treating diarrhoea in children. *Cochrane Database of Systematic Reviews* 6:CD005436, 2012.

¹⁵⁴ Bhutta, Das, Rizvi, Gaffey, Walker, Horton, Webb, Lartey and Black

supplementation on child stunting,¹⁵⁵ whereas a 2011 meta-analysis of 36 studies found a small but significant positive effect on reduction of child stunting.¹⁵⁶

Deworming for children

Definition: periodic treatment with deworming drugs.¹⁵⁷

For individual children aged 12–59 months with helminth infection, there is evidence that deworming drugs have a positive impact on nutrition. Among these children, deworming drugs lead to improved micronutrient status (haemoglobin levels increased by 1.71 g/L weighted mean difference), reduced stunting (single dose associated with a 0.14 cm increase in height) and weight gain (single dose associated with a 0.24 kg increase in weight, and multiple doses associated with a 0.10 kg increase in weight at up to 12 months followup).¹⁵⁸

However, a recent Cochrane review found no evidence that blanket antihelminthic (deworming) campaigns have a beneficial impact on weight gain or haemoglobin levels in children.¹⁵⁹ This was confirmed in the 2013 *Lancet* series. The review confirmed that evidence indicates a positive impact on weight gain and haemoglobin levels for targeted campaigns that treat children with helminth infection.¹⁶⁰

Prevention or treatment of moderate acute undernutrition in non-emergency settings¹⁶¹

Definition: optimal use of locally available foods to improve nutritional status or, in situations of food shortage or where some nutrients are not sufficiently available through local foods, the use of specially manufactured supplementary foods.¹⁶²

The optimal use of locally available and accessible nutrient-dense foods that provide sufficient energy and nutrients can improve the nutritional status of children and prevent them from becoming severely wasted.¹⁶³

Under conditions such as drought or harvest failure, where locally available foods provide insufficient energy and/or nutrients, supplementary foods can be used to supplement the regular diet and

¹⁵⁵ U Ramakrishnan, P Nguyen and R Martorell, Effects of micronutrients on growth of children under 5 years of age. *American Journal of Clinical Nutrition* 89(1):191–203, 2009.

¹⁵⁶ A Imdad and ZA Bhutta, Effect of preventive zinc supplementation on linear growth in children under 5 years of age in developing countries: a meta-analysis of studies for input to the lives saved tool. *BMC Public Health* 11(Suppl 3):S22, 2011.

¹⁵⁷ World Health Organization, *e-Library of evidence for nutrition actions (eLENA)*

¹⁵⁸ Bhutta, Ahmed, Black, Cousens, Dewey, Giugliani, Haider, Kirkwood, Morris, Sachdev and Shekar

¹⁵⁹ D Taylor-Robinson, N Maayan, K Soares-Weiser, S Donegan and P Garner, Deworming drugs for soil-transmitted intestinal worms in children: effects on nutritional indicators, haemoglobin and school performance (review). *Cochrane Database of Systematic Reviews* 7:CD000371.pub000374, 2012.

¹⁶⁰ Taylor-Robinson, Maayan, Soares-Weiser, Donegan and Garner

¹⁶¹ 'Non-emergency' refers to settings where populations are not affected by war, population displacement, famine or natural disasters.

¹⁶² World Health Organization, *e-Library of evidence for nutrition actions (eLENA)*

¹⁶³ A Ashworth and E Ferguson, Dietary counselling in the management of moderate malnourishment in children. *Food and Nutrition Bulletin* 30(Suppl 3):S405–S433, 2009.

improve the intake of required nutrients.¹⁶⁴ A cluster randomised controlled trial of supplementary feeding of children aged 0–7 years, with followup at age 25–42 years, found that receiving a supplement before 3 years of age was associated with higher cognitive test scores, higher wages and more years of schooling, suggesting improved cognitive development due to better nutrition.¹⁶⁵ Other studies of the nutritional impact of supplementary feeding have found evidence of a positive impact on child height and weight (for example, in Ghana ¹⁶⁶ and Haiti¹⁶⁷), or on child weight but not height (for example, in Ecuador¹⁶⁸ and Malawi¹⁶⁹).

However, there is currently a lack of evidence regarding the required nutrient intake for children with moderate undernutrition, through both locally available and supplementary foods.¹⁷⁰

Community-based management of severe acute undernutrition with ready-to-use therapeutic foods in non-emergency settings

Definition: provision of specially manufactured therapeutic foods to children with severe acute undernutrition (weight-for-height z-score less than -3) in community settings. For children with complications—estimated at up to 15 per cent of cases—the World Health Organization (WHO) recommends facility-based management according to the WHO protocol (see below); community-based management has been recommended for the remaining 85 per cent or more of cases.¹⁷¹

A recent systematic review confirmed that ready-to-use therapeutic foods provide a weight gain of 3 grams per kilogram of bodyweight per day, and that they are safe and effective for use in home and community settings.¹⁷²

However, the cost-effectiveness of ready-to-use therapeutic foods compared with family foods has not been confirmed. In settings where households are able to access sufficient nutrient-rich foods and

¹⁶⁴ S de Pee and M Bloem, Current and potential role of specially formulated foods and food supplements for preventing malnutrition among 6 to 23 month-old children and for treating moderate malnutrition among 6 to 59-month old children. *Food and Nutrition Bulletin* 30(Suppl 3):S434–S463, 2009.

¹⁶⁵ J Hoddinott, J Maluccio, J Behrman, R Flores and R Martorell, Effect of a nutrition intervention during early childhood on economic productivity in Guatemalan adults. *Lancet* 371:411–416, 2008.

¹⁶⁶ S Adu-Afarwuah, A Lartey, K Brown, S Zlotkin, A Briend and K Dewey, Randomized comparison of 3 types of micronutrient supplements for home fortification of complementary foods in Ghana: effects on growth and motor development. *American Journal of Clinical Nutrition* 86:412–420, 2007.

¹⁶⁷ M Ruel, P Menon, J-P Habicht, C Loechl, G Bergeron, G Pelto, M Arimond, J Maluccio, L Michaud and B Hankebo, Age-based preventive targeting of food assistance and behaviour change and communication for reduction of childhood undernutrition in Haiti: a cluster randomised trial. *Lancet* 371:588–595, 2008.

¹⁶⁸ C Lutter, A Rodriguez, G Fuenmayor, L Avila, F Sempertegui and J Escobar, Growth and micronutrient status in children receiving a fortified complementary food. *Journal of Nutrition* 138(2):379–388, 2008.

¹⁶⁹ C Lin, M Manary, K Maleta, A Briend and P Ashorn, An energy-dense complementary food is associated with a modest increase in weight gain when compared with a fortified porridge in Malawian children aged 6–18 months. *Journal of Nutrition* 138:593–598, 2008.

¹⁷⁰ World Health Organization, *Technical note: supplementary foods for the management of moderate acute malnutrition in infants and children 6–59 months of age*, WHO, Geneva, 2012.

¹⁷¹ Bhutta, Das, Rizvi, Gaffey, Walker, Horton, Webb, Lartey and Black

¹⁷² T Gera, Efficacy and safety of therapeutic nutrition products for home based therapeutic nutrition for severe acute malnutrition: a systematic review. *Indian Paediatrics* 47(8):709–718, 2010.

support from a well-functioning health system, ready-to-use therapeutic foods may be the less preferred option.¹⁷³

Facility-based management of severe acute undernutrition according to WHO protocol in non-emergency settings

Definition: use of the WHO protocol for facility-based management of severe acute undernutrition. The WHO protocol is a comprehensive set of guidelines for health practitioners¹⁷⁴ and is recommended for use in cases with complications, estimated at 15 per cent of cases of severe acute undernutrition.¹⁷⁵

Case fatality rates in children treated in accordance with the WHO protocol are as low as 3.4 per cent, although a case fatality rate of 35 per cent was observed in a group of HIV-positive children.¹⁷⁶ Among children with severe acute undernutrition who are treated in facilities but not in accordance with the WHO protocol, case fatality rates of 20–30 per cent are typical.¹⁷⁷

Balanced dietary supplements during pregnancy

Definition: provision of balanced dietary supplements to women during pregnancy.

The 2008 *Lancet* series systematic review concluded that the evidence for balanced energy and protein supplements (in which protein accounts for less than 25 per cent of the total energy content) during pregnancy is sufficiently robust to support implementation of this intervention in specific situational contexts. Citing a 2003 Cochrane review, the series reports that balanced protein–energy supplementation is associated with a reduction in risk of infants who are small for gestational age by 32 per cent and a reduction in stillbirth by 45 per cent.¹⁷⁸ Subsequently, a meta-analysis of 11 randomised controlled trials and quasi-randomised controlled trials confirmed that providing pregnant women with balanced protein–energy supplementation (in which protein accounts for less than 25 per cent of total energy) can reduce the risk of infants who are small for gestational age by 31 per cent, especially in malnourished pregnant women.¹⁷⁹ The 2013 *Lancet* series also included dietary supplements during pregnancy among cost-effective nutrition-specific interventions.

Deworming during pregnancy

Definition: drug treatment with deworming drugs during pregnancy.

¹⁷³ A Ashworth, Efficacy and effectiveness of community-based treatment of severe malnutrition. *Food and Nutrition Bulletin* 27(Suppl 3):S24–S48, 2006.

¹⁷⁴ World Health Organization, *Training course on the management of severe malnutrition*, WHO, accessed 11 July 2013, www.who.int/nutrition/publications/severemalnutrition/training_inpatient_MSM/en/index.html.

¹⁷⁵ Bhutta, Das, Rizvi, Gaffey, Walker, Horton, Webb, Lartey and Black

¹⁷⁶ Bhutta, Das, Rizvi, Gaffey, Walker, Horton, Webb, Lartey and Black

¹⁷⁷ Bhutta, Das, Rizvi, Gaffey, Walker, Horton, Webb, Lartey and Black

¹⁷⁸ Bhutta, Ahmed, Black, Cousens, Dewey, Giugliani, Haider, Kirkwood, Morris, Sachdev and Shekar

¹⁷⁹ A Imdad and Z Bhutta, Maternal nutrition and birth outcomes: effect of balanced protein-energy supplementation. *Paediatric and Perinatal Epidemiology* 26(1):178–190, 2012.

Helminth (worm) infections during pregnancy lead to maternal deficiencies in iron, protein and total energy. These deficiencies lead to maternal anaemia and low weight gain during pregnancy, resulting in a higher risk of low birthweight.¹⁸⁰

The 2008 *Lancet* series found that the evidence for deworming in pregnancy was sufficient for implementation of this intervention in specific situational contexts. Deworming during pregnancy is associated with a reduced risk of maternal anaemia. The mean decline in maternal haemoglobin between first and third trimester was found to be 6.6 grams per litre less for women who received deworming treatment than with a placebo.¹⁸¹ However, the 2013 series reported that five randomised controlled trials found no significant benefits.

Maternal education on infant and young child feeding, and child care

Definition: provision of education to mothers during or after pregnancy, relating specifically to feeding and care practices for infants and young children.

Maternal education on feeding and care can be effective in improving feeding practices. However, this intervention is less likely to be effective when it is delivered in isolation.¹⁸² Conversely, a randomised controlled trial in Iran demonstrated that specific education on care practices can be highly effective and have a positive impact on child stunting as part of a broader, multisectoral intervention that simultaneously strengthens the capacity of mothers to deliver quality care and develops an enabling environment for appropriate feeding and care practices.¹⁸³ Additionally, evidence from Madagascar indicates that maternal education on feeding and care can be effective where women's existing social networks are supportive, and where additional professional support exists to maintain the quality of care.¹⁸⁴

Supplementary feeding of adolescent girls

Definition: provision of micronutrient supplements, nutrient-dense food and/or energy-rich food to adolescent girls, often (but not always) through school-based programs.

Iron-folate supplementation provided to adolescent girls can increase haemoglobin levels, reducing their risk of developing anaemia both before and during pregnancy. A program in India that combined iron-folate supplements with nutrition education was found to reduce anaemia prevalence by up to 20 per cent.¹⁸⁵ A cluster randomised controlled trial of a school-based supplementary feeding program in Uganda found that adolescent girls aged 10–13 years experienced a significant decline in

¹⁸⁰ Department for International Development, *The neglected crisis of undernutrition: evidence for action*

¹⁸¹ Bhutta, Ahmed, Black, Cousens, Dewey, Giugliani, Haider, Kirkwood, Morris, Sachdev and Shekar

¹⁸² C Walsh, A Dannhauser and G Joubert, The impact of a nutrition education programme on the anthropometric nutritional status of low-income children in South Africa. *Public Health Nutrition* 5:3–9, 2002.

¹⁸³ R Sheikholeslam, M Kimiagar, F Siasi, Z Abdollahi, A Jazayeri, K Keyghobadi, M Ghaffarpour, F Noroozi, M Kalantari, N Minaei, F Eslami and H Hormozdyari, Multi-disciplinary intervention for reducing malnutrition among children in the Islamic Republic of Iran. *Eastern Mediterranean Health Journal* 10:844–852, 2004.

¹⁸⁴ E Galasso and N Umapathi, *Improving nutritional status through behavioral change: lessons from Madagascar*, World Bank, Washington, DC, 2007.

¹⁸⁵ R Haider, *Adolescent nutrition: a review of the situation in selected South-East Asian countries*, Regional Office for South-East Asia, World Health Organization, New Delhi, 2006.

the prevalence of mild anaemia compared with the control group.¹⁸⁶ This intervention was not reviewed in the 2013 *Lancet* series.

Special populations: malaria prevention during pregnancy in endemic areas

Definition: malaria prophylaxis and intermittent preventive treatment with an antimalarial drug, or the use of insecticide-treated bed nets, during pregnancy.¹⁸⁷

Maternal malaria during pregnancy leads to low birthweight, due to placental infection and/or malaria-induced maternal anaemia.¹⁸⁸

A systematic review of randomised controlled trials reported in the 2013 *Lancet* series found that, in malaria-endemic areas, malaria prophylaxis and intermittent preventive treatment for malaria reduced the risk of low birthweight by 43 per cent in babies born to the first or second pregnancy.¹⁸⁹ A further systematic review of randomised controlled trials found that the use of insecticide-treated bed nets during pregnancy reduced the prevalence of low birthweight by 23 per cent.¹⁹⁰

Nutrition-specific interventions targeting type I nutrient deficiencies

Table 2 summarises the strength of evidence for nutrition-specific interventions targeting type I deficiencies, according to the *Lancet* 2013 series.

Table 2 Summary: strength of evidence for nutrition-specific interventions targeting type I deficiencies, according to the *Lancet* 2013 series

Intervention	Evidence for impact on child undernutrition
Periodic vitamin A supplements in children 6 months – 5 years	Strong
Multiple micronutrient supplements for pregnant women	Strong effect on maternal anaemia and low birthweight
Multiple micronutrient supplementation for children	Moderate effect on anaemia
Iron–folate supplements for pregnant women to prevent anaemia	Moderate effect on low birthweight and anaemia
Iodised oil capsules where iodised salt is unavailable	Strong
Universal salt iodisation	Strong
Iron fortification of staple foods	Strong
Biofortification of staple foods	Weak; moderate evidence of indirect impact

¹⁸⁶ S Adelman, D Gilligan, J Konde-Lule and H Alderman, *School feeding reduces anemia prevalence in adolescent girls and other vulnerable household members in a cluster randomized controlled trial in Uganda*, International Food Policy Research Institute, Washington, DC, 2012.

¹⁸⁷ F ter Kuile, A van Eijk and S Filler, Effect of sulfadoxine-pyrimethamine resistance on the efficacy of intermittent preventive therapy for malaria control during pregnancy: a systematic review. *JAMA* 297:2603–2616, 2007.

¹⁸⁸ Department for International Development, *The neglected crisis of undernutrition: evidence for action*

¹⁸⁹ ter Kuile, van Eijk and Filler

¹⁹⁰ C Gamble, JP Ekwaru and FO ter Kuile, Insecticide-treated nets for preventing malaria in pregnancy. *Cochrane Database of Systematic Reviews* 2:CD003755, 2009.

Periodic vitamin A supplements

Definition: provision of vitamin A supplements to children aged 6 months to 5 years. In settings where vitamin A deficiency is a public health problem,^{191,192} WHO recommends high-dose vitamin A supplementation every 4–6 months for infants and children 6–59 months of age, as a public health intervention to reduce child morbidity (including blindness) and mortality.¹⁹³

Two Cochrane systematic reviews assessing the effects and safety of vitamin A supplementation in children 6–59 months of age were updated for this WHO guideline.¹⁹⁴ One of these evaluated the effectiveness of vitamin A supplements in preventing morbidity and mortality in children 6–59 months of age.¹⁹⁵ It showed that giving vitamin A supplements to children reduces the rates of mortality and some diseases.

A meta-analysis of 17 trials (11 in Asia, 5 in Africa and 1 in Latin America) for all-cause mortality indicated that vitamin A supplementation reduces the overall risk of death in children aged 6–59 months by 24 per cent (risk ratio 0.76; 95 per cent confidence interval 0.69–0.83).¹⁹⁶ The most recent meta-analysis of vitamin A trials, published in 2011,¹⁹⁷ also found a reduction in all-cause mortality of 24 per cent. Seven trials reported a 28 per cent reduction in mortality associated with diarrhoea (risk ratio 0.72; 0.57–0.91). Vitamin A supplementation was associated with a reduced incidence of diarrhoea (risk ratio 0.85; 0.82–0.87) and measles (risk ratio 0.50; 0.37–0.67), and a reduced prevalence of vision problems, including night blindness (risk ratio 0.32; 0.21–0.50) and xerophthalmia (risk ratio 0.31; 0.22–0.45).

When an unpublished cluster randomised trial involving 1 million children in north India (the DEVTA trial) was considered in the meta-analysis, vitamin A supplementation reduced the effect size of all-cause mortality from 24 per cent to 12 per cent (risk ratio 0.88; 0.84–0.94). This trial was subsequently published in *The Lancet* in early 2013.¹⁹⁸ The trial's study methods have been widely

¹⁹¹ World Health Organization, *Global prevalence of vitamin A deficiency in populations at risk 1995–2005: WHO global database on vitamin A deficiency*, WHO, Geneva, 2009.

¹⁹² Determination of vitamin A deficiency as a public health problem involves estimating the prevalence of deficiency in a population by using specific biochemical and clinical indicators of vitamin A status. Classification of countries based on the most recent estimates is available in World Health Organization, *Global prevalence of vitamin A deficiency in populations at risk 1995–2005: WHO global database on vitamin A deficiency*

¹⁹³ World Health Organization, *Guideline: vitamin A supplementation in infants and children 6–59 months of age*, WHO, Geneva, 2011.

¹⁹⁴ A Imdad, K Herzer, E Mayo-Wilson, M Yakoob and Z Bhutta, Vitamin A supplementation for preventing morbidity and mortality in children from 6 months to 5 years of age. *Cochrane Database of Systematic Reviews* (12):CD008524, 2010.

J Iriam, M Visser, N Rollins and N Siegfried, Micronutrient supplementation in children and adults with HIV infection. *Cochrane Database of Systematic Reviews* 12:CD003650, 2010.

¹⁹⁵ Imdad, Herzer, Mayo-Wilson, Yakoob and Bhutta

¹⁹⁶ E Mayo-Wilson, A Imdad, K Herzer, M Yakoob and Z Bhutta, Vitamin A supplements for preventing mortality, illness, and blindness in children aged under 5: systematic review and meta-analysis. *BMJ* 343:d5094, 2011.

¹⁹⁷ Mayo-Wilson, Imdad, Herzer, Yakoob and Bhutta

¹⁹⁸ S Awasthi, R Peto, S Read, S Clark, V Pande, D Bundy and the DEVTA (Deworming and Enhanced Vitamin A) team, Vitamin A supplementation every 6 months with retinol in 1 million pre-school children in north India: DEVTA, a cluster-randomised trial. *Lancet* 381(9876):1469–1477, 2013.

criticised because it was not designed as an efficacy trial.¹⁹⁹ Critics have characterised the study as a program evaluation and challenge its inclusion in a meta-analysis that included many rigorously designed randomised controlled trials.

The effect of vitamin A supplementation on the antibody response to measles vaccination has recently been evaluated in an additional review.²⁰⁰ A meta-analysis of seven trials indicated that vitamin A supplementation at 6 or 9 months of age did not affect the measles vaccine response (seroconversion rates). No study has prospectively assessed the impact of co-administration of vitamin A and measles vaccine on child mortality.

Children with concurrent vitamin A deficiency and measles can suffer severe complications, and immediate vitamin A therapy significantly reduces the risk of severe complications and mortality. WHO therefore recommends that children be treated with high-dose vitamin A supplements during episodes of measles. All published trials to date suggest two doses of 200 000 IU (international units).²⁰¹

Several trials have found that combining zinc and vitamin A supplements has a greater effect on reducing morbidity from diarrhoeal disease and acute respiratory infections than vitamin A alone.²⁰² However, routine combined zinc and vitamin A supplementation in children is not yet recommended by WHO.

Multiple micronutrient supplements for pregnant women

Definition: provision of three or more micronutrients as a supplement to women during pregnancy.²⁰³ Most programs focus on iron, iodine and vitamin A; WHO and the United Nations Children's Fund (UNICEF) recommend a total of 15 micronutrients.^{204,205}

A review of randomised controlled trials found that multiple micronutrient supplements provided to women during pregnancy led to a 14 per cent reduction in intrauterine growth restriction. This provides direct evidence of the impact of this intervention on the undernutrition of children in the womb.²⁰⁶

¹⁹⁹ A Sommer, K West and R Martorell, Vitamin A supplementation in Indian children. *Lancet* 382(9892):591, 2013.

²⁰⁰ M Savy, K Edmond, PE Fine, A Hall, BJ Hennig, SE Moore, K Mulholland, U Schaible and AM Prentice, Landscape analysis of interactions between nutrition and vaccine responses in children. *Journal of Nutrition* 2154S–2218S, 2009.

²⁰¹ World Health Organization, *Vitamin A supplements: a guide to their use in the treatment and prevention of vitamin A deficiency and xerophthalmia*, WHO, Geneva, 1997.

²⁰² M Rahman, S Vermund, M Wahed, G Fuchs, A Baqui and J Alvarez, Simultaneous zinc and vitamin A supplementation in Bangladeshi children: randomised double blind controlled trial. *BMJ* 323:314–318, 2001.

²⁰³ Bhutta, Ahmed, Black, Cousens, Dewey, Giugliani, Haider, Kirkwood, Morris, Sachdev and Shekar

²⁰⁴ DI Thurnham. Multiple micronutrient nutrition: evidence from history to science to effective programs. Paper presented at the 2nd World Congress of Public Health, Portugal, 2010.

²⁰⁵ Vitamins A, B1, B2, B6, B12, C, D and E; and niacin, folic acid, iron, zinc, copper, selenium and iodine.

²⁰⁶ Bhutta, Ahmed, Black, Cousens, Dewey, Giugliani, Haider, Kirkwood, Morris, Sachdev and Shekar; BA Haider and ZA Bhutta, Multiple-micronutrient supplementation for women during pregnancy. *Cochrane Database of Systematic Reviews* 11:CD004905, 2012.

Additionally, there is strong evidence that multiple micronutrient supplements are effective in reducing maternal anaemia, which is a predisposing factor for low birthweight, by 39 per cent compared with either a placebo or two or fewer micronutrients.²⁰⁷ This intervention has a greater impact on low birthweight than iron–folate supplementation, leading to a 12 per cent greater reduction in low birthweight.²⁰⁸

However, multiple micronutrients are most effective in individuals who receive adequate amounts of energy, protein and fat; people with type II undernutrition therefore may not benefit from multiple micronutrient supplements.²⁰⁹

Multiple micronutrient supplementation for children

Definition: provision of three or more micronutrients as a supplement to children.²¹⁰ Most programs focus on iron in combination with other micronutrients.²¹¹

Compared with two or fewer micronutrients, multiple micronutrient supplementation has been associated with increased height (0.13 cm mean difference) and weight gain (0.14 kg mean difference).²¹² A systematic review of 17 randomised controlled trials²¹³ found that multiple micronutrient powders were associated with reduced anaemia (34 per cent reduction) and improved iron and vitamin A status in children aged 6 months – 11 years. However, the same review found a significant association between multiple micronutrient powders and a 4 per cent increase in diarrhoea.²¹⁴ The 2013 *Lancet* series recommends further research into the impacts and safety of multiple micronutrient supplements for children.²¹⁵

Iron–folate supplements for pregnant women to prevent anaemia

Definition: intermittent iron–folate supplementation during pregnancy.²¹⁶

It is well established that iron–folate supplements increase haemoglobin levels.²¹⁷ The 2013 *Lancet* series found that supplementation reduced the risk of anaemia in pregnant women by 66 per cent.²¹⁸

²⁰⁷ Bhutta, Ahmed, Black, Cousens, Dewey, Giugliani, Haider, Kirkwood, Morris, Sachdev and Shekar

²⁰⁸ Bhutta, Das, Rizvi, Gaffey, Walker, Horton, Webb, Lartey and Black

²⁰⁹ JP Habicht and GH Peltó, Multiple micronutrient interventions are efficacious, but research on adequacy, plausibility, and implementation needs attention. *Journal of Nutrition* 142(1):205S–209S, 2012; Thurnham, Multiple micronutrient nutrition: evidence from history to science to effective programs

²¹⁰ Bhutta, Das, Rizvi, Gaffey, Walker, Horton, Webb, Lartey and Black

²¹¹ Bhutta, Das, Rizvi, Gaffey, Walker, Horton, Webb, Lartey and Black

²¹² LH Allen, JM Pearson and DK Olney, Provision of multiple rather than two or fewer micronutrients more effectively improves growth and other outcomes in micronutrient-deficient children and adults. *Journal of Nutrition* 139:1022–1030, 2009.

²¹³ RA Salam, C MacPhail, JK Das and ZA Bhutta, Effectiveness of micronutrient powders (MNP) in women and children. *BMC Public Health* 13(Suppl 3):S22, 2013.

²¹⁴ Salam, MacPhail, Das and Bhutta

²¹⁵ Bhutta, Das, Rizvi, Gaffey, Walker, Horton, Webb, Lartey and Black

²¹⁶ World Health Organization, *e-Library of evidence for nutrition actions (eLENA)*

²¹⁷ T Sanghvi, P Harvey and E Wainwright, Maternal iron-folic acid supplementation programs: evidence of impact and implementation. *Food and Nutrition Bulletin* 31(2 Suppl):S100–S107, 2010.

There is some evidence that iron–folate supplementation from the second trimester of pregnancy, which is when existing programs tend to begin, is insufficient to combat pre-existing anaemia and should therefore not be considered a form of treatment for anaemia.²¹⁹ The potential greater positive impact of multiple micronutrient supplementation²²⁰ needs to be included in assessments of the cost-effectiveness and opportunity costs of iron–folate supplementation.

Iodised oil capsules where iodised salt is unavailable

Definition: distribution of oral iodised oil capsules in areas with low coverage of iodised salt. WHO and UNICEF define ‘low coverage’ as less than 20 per cent of households with access to iodised salt, or less than 90 per cent of households with access to iodised salt and no increase in the proportion of households with access to iodised salt over a 2-year period.²²¹ WHO and UNICEF recommend iodine supplementation in these settings for pregnant and lactating women, and children 7–24 months of age.²²²

Iodine deficiency, as a type I nutrient deficiency, is a form of undernutrition.

In a setting where iodised salt was unavailable, oral iodised oil has been associated with a reduction of mortality in infants by 78 per cent during the first 2 months of followup.²²³ Universal salt iodisation replaces this intervention in most settings,²²⁴ but this intervention is expected to have a substantial impact on child nutrition and health where iodised salt remains inaccessible.

Universal salt iodisation

Definition: fortification with iodine of all salt used for human and animal consumption.²²⁵ Universal salt iodisation is an effective intervention to reduce iodine deficiency in children.²²⁶ Iodine is essential for healthy brain development in the fetus and young child.

The 2008 *Lancet* series found universal salt iodisation to reduce the risk of iodine deficiency in children by 41 per cent.²²⁷ The cost-effectiveness of this intervention was confirmed in the 2013 *Lancet* series.

²¹⁸ Bhutta, Das, Rizvi, Gaffey, Walker, Horton, Webb, Lartey and Black

²¹⁹ Department for International Development, *An update of ‘The neglected crisis of undernutrition: evidence for action’*

²²⁰ Bhutta, Ahmed, Black, Cousens, Dewey, Giugliani, Haider, Kirkwood, Morris, Sachdev and Shekar

²²¹ World Health Organization and UNCs Fund, *Reaching optimal iodine nutrition in pregnant and lactating women and young children*, joint statement by the World Health Organization and the United Nations Children's Fund, Geneva, 2007.

²²² World Health Organization and Fund, *Reaching optimal iodine nutrition in pregnant and lactating women and young children*

²²³ C Cobra, R Muhilal, K Rusmil, D Rustama, Djatnika, S Suwardi, D Permaesih, Muherdiyantiningsih, S Martuti and R Semba, Infant survival is improved by oral iodine supplementation. *Journal of Nutrition* 127:574–578, 1997.

²²⁴ Bhutta, Ahmed, Black, Cousens, Dewey, Giugliani, Haider, Kirkwood, Morris, Sachdev and Shekar

²²⁵ World Health Organization, *e-Library of evidence for nutrition actions (eLENA)*

²²⁶ Department for International Development, *An update of ‘The neglected crisis of undernutrition: evidence for action’*

²²⁷ Bhutta, Ahmed, Black, Cousens, Dewey, Giugliani, Haider, Kirkwood, Morris, Sachdev and Shekar

Iron fortification of staple foods

Definition: addition of selected iron compounds to staple foods such as wheat flour, typically during food processing by the food industry.²²⁸

Iron fortification of staple foods increases haemoglobin levels, reducing the risk of anaemia at a population level by up to 63 per cent.²²⁹ In children, iron fortification has been shown to reduce the odds of experiencing iron deficiency anaemia by 28 per cent.²³⁰

Educational messages on the fortification of staple foods have been shown to increase children's dietary intake of fortified foods at a population level.²³¹

Biofortification of staple foods

Definition: the use of conventional breeding techniques and biotechnology to improve the micronutrient quality of staple crops. Current biofortification efforts are focused on the micronutrients iron, zinc and vitamin A.²³²

Additional research is needed to develop the evidence base for biofortification.²³³ However, predictive analyses suggest that this intervention can be cost-effective and provide greatest benefit to the poorest people.²³⁴

There is evidence to support the principle of biofortification. Poor people tend to rely on energy-rich but nutrient-poor staple foods to meet their minimum energy requirements, which leads to the 'hidden hunger' of micronutrient deficiencies. A multicountry study found that the minimum cost of a diet that provides sufficient energy and nutrients is beyond the means of the majority of poor households.²³⁵ By increasing the micronutrient content of energy-rich staple foods, biofortification is expected to have a significant impact on nutrition status.²³⁶

There is also evidence that it is possible to increase the micronutrient content of some energy-rich staple foods. A high-zinc rice was developed and scheduled for release in Bangladesh in 2012.²³⁷ In the Philippines, so-called 'golden rice', enriched with vitamin A, is in the process of development and

²²⁸ World Health Organization, *e-Library of evidence for nutrition actions (eLENA)*

²²⁹ Department for International Development, *An update of 'The neglected crisis of undernutrition: evidence for action'*

²³⁰ Bhutta, Ahmed, Black, Cousens, Dewey, Giugliani, Haider, Kirkwood, Morris, Sachdev and Shekar

²³¹ N Steyn, J Nel and D Labadarios, Will fortification of staple foods make a difference to the dietary intake of South African children? *South African Journal of Clinical Nutrition* 21(1):22–26, 2008.

²³² C Hotz and B McClafferty, From harvest to health: challenges for developing biofortified staple foods and determining their impact on micronutrient status. *Food and Nutrition Bulletin* 28(2 Suppl):S271–S279, 2007.

²³³ World Health Organization, *e-Library of evidence for nutrition actions (eLENA)*

²³⁴ B McClafferty and N Russell, *Biofortification: harnessing agricultural technology to improve health of the poor*, International Food and Policy Research Institute, Washington, DC. 2002; P Nestel, H Bouis, J Meenakshi and W Pfeiffer, Biofortification of staple food crops. *Journal of Nutrition* 136:1064–1067, 2006.

²³⁵ Chastre, Duffield, Kindness, LeJeune and Taylor

²³⁶ JV Meenakshi, *Cost-effectiveness of biofortification*, Best practice paper, Copenhagen Consensus Center, 2008.

²³⁷ Meenakshi

regulatory approval.²³⁸ Additionally, there is evidence that the consumption of nutrient-dense foods improves child micronutrient status. The consumption of orange sweet potato, which is naturally rich in vitamin A, was found to reduce vitamin A deficiency in young children.²³⁹

However, gaps in the evidence base for biofortification remain. It is unclear which staple foods can be fortified with which nutrients, what can be achieved through conventional breeding techniques and what may require the use of biotechnology, and how biofortified crops can be effectively and cost-effectively disseminated.²⁴⁰

Special populations: food preparation to address thiamine deficiency (beriberi) in Southeast Asia

Definition: preparation of staple foods in ways that retain their thiamine content.

In Southeast Asia, where rates of infantile beriberi are the highest in the world and white rice is the predominant staple food, the consumption of polished white rice is associated with thiamine deficiency at a population level.²⁴¹ Maternal thiamine deficiency can lead to potentially fatal beriberi in breastfed infants through the reduced nutrient content of breastmilk.²⁴² Rice preparation methods at the household level, such as reducing soaking times and retaining water used for soaking, are associated with reduced thiamine deficiency in breastfed infants.²⁴³ Preparation of food to address thiamine deficiency was not considered in the 2008 or 2013 *Lancet* series but is particularly relevant to populations in Southeast Asia with low dietary diversity.²⁴⁴

Special populations: antenatal vitamin A supplementation in HIV-positive women

Definition: targeted provision of vitamin A supplements to HIV-positive women during pregnancy.

The 2008 *Lancet* series found that antenatal vitamin A supplementation has a positive impact on low birthweight in pregnant women who are HIV-positive, although no impact was found in pregnant women who are HIV-negative.²⁴⁵ The 2013 *Lancet* series did not consider the impact of antenatal

²³⁸ B Lomborg, A golden rice opportunity. *Project Syndicate* 2013, www.project-syndicate.org/commentary/the-costs-of-opposing-gm-foods-by-bj-rn-lomborg.

²³⁹ J Low, N Arimond, B Ousman, F Cunguara and D Tschirley, A food-based approach introducing orange sweet potatoes increased vitamin A intake and serum retinol concentrations in young children in rural Mozambique. *Journal of Nutrition* 137:1320–1327, 2007.

²⁴⁰ Meenakshi

²⁴¹ R Gross and W Schultink, Micronutrient deficiency in urban Indonesia. *Archivos Latinoamericanos de Nutrición* 47(2 Suppl 1):50–53, 1997.

LH Allen, B vitamins in breast milk: relative importance of maternal status and intake, and effects on infant status and function. *Advances in Nutrition* 3:362–369, 2012.

²⁴² Allen

²⁴³ D Soukaloun, S Kounnavong, B Pengdy, B Bouphe, S Durondej, K Olness, P Newton and N White, Dietary and socio-economic factors associated with beriberi in breastfed Lao infants. *Annals of Tropical Paediatrics* 23(3):181–186, 2003.

²⁴⁴ C Luxemburger, NG White, F ter Kuile, HM Singh, I Allier-Frachon, M Ohn, T Chongsuphajaisiddhi and F Nosten, Beri-beri: the major cause of infant mortality in Karen refugees. *Transactions of the Royal Society of Tropical Medicine and Hygiene* 97(2):251–255, 2003.

²⁴⁵ Bhutta, Ahmed, Black, Cousens, Dewey, Giugliani, Haider, Kirkwood, Morris, Sachdev and Shekar

vitamin A supplementation. Since high doses of vitamin A can interfere with fetal development, 3000 µg is recommended as the maximum daily supplement for all pregnant women.²⁴⁶

Nutrition-sensitive interventions

Nutrition-sensitive interventions influence nutrition outcomes, in both the short and long term, through action on the distal risk factors of child undernutrition.

It is methodologically more challenging to trace and measure the impact of nutrition-sensitive interventions on child nutrition outcomes than for nutrition-specific interventions.²⁴⁷ Nutrition-sensitive interventions have also been far less likely than nutrition-specific interventions to be evaluated for their impact on child nutrition status.²⁴⁸ Consequently, the evidence base for nutrition-sensitive interventions is smaller, patchier and more complex.

Improved water, sanitation and hygiene practices

Improved water, sanitation and hygiene practices comprise improved water supply and water treatment, improved sanitation facilities, and education on hygiene, including hand-washing.²⁴⁹ There is a lack of evidence for the direct impact of hygiene interventions on stunting or underweight in children.²⁵⁰ However, there is robust evidence that hygiene interventions are effective in reducing diarrhoea and dysentery, which are known to affect child nutrition status. A meta-analysis of three systematic reviews²⁵¹ has confirmed that hand-washing and hygiene interventions, including water treatment and improved sanitation facilities, reduce the incidence of diarrhoea by 30 per cent.²⁵²

²⁴⁶ JL Simpson, LB Bailey, K Pietrzik, B Shane and W Holzgreve, Micronutrients and women of reproductive potential: required dietary intake and consequences of dietary deficiency or excess. Part II—vitamin D, vitamin A, iron, zinc, iodine, essential fatty acids. *Journal of Maternal-Fetal and Neonatal Medicine* 24(1):1–24, 2011.

²⁴⁷ United Nations Children's Fund, *Improving child nutrition: the achievable imperative for global progress*; Department for International Development, *An update of 'The neglected crisis of undernutrition: evidence for action'*

²⁴⁸ Department for International Development, *The neglected crisis of undernutrition: evidence for action*

²⁴⁹ Bhutta, Ahmed, Black, Cousens, Dewey, Giugliani, Haider, Kirkwood, Morris, Sachdev and Shekar; Department for International Development, *An update of 'The neglected crisis of undernutrition: evidence for action'*; World Health Organization, *e-Library of evidence for nutrition actions (eLENA)*

²⁵⁰ Department for International Development, *An update of 'The neglected crisis of undernutrition: evidence for action'*

²⁵¹ V Curtis and S Cairncross, Effect of washing hands with soap on diarrhoea risk in the community: a systematic review. *Lancet Infectious Diseases* 3:275–281, 2003.
L Fewtrell, R Kaufmann, D Kay, W Enanoria, L Haller and J Colford, Water, sanitation, and hygiene interventions to reduce diarrhoea in less developed countries: a systematic review and meta-analysis. *Lancet Infectious Diseases* 5:42–52, 2005.
A Zwane and M Kremer, *What works in fighting diarrheal diseases in developing countries? A critical review*, CID working paper 140, Center for International Development, Harvard University, Cambridge, USA, 2007.

²⁵² Bhutta, Ahmed, Black, Cousens, Dewey, Giugliani, Haider, Kirkwood, Morris, Sachdev and Shekar

Improved access to health services

Evidence for the impact of improved access to health services on child nutrition status is mainly derived from evaluation of conditional cash transfer programs, under which caregivers are provided with a cash incentive to use existing health services. Increased use of health services through conditional cash transfer programs has been associated with significant reductions in stunting.²⁵³ However, a systematic review has established that this positive impact is contingent on households being able to access quality care through health services.²⁵⁴

Family planning

Family planning is defined as use of contraceptive methods, particularly modern methods, and the treatment of involuntary infertility to allow individuals and couples to anticipate and attain their desired number of children, and the spacing and timing of their births.

Family planning can promote child nutrition through birth spacing and delayed childbearing.

Short intervals between pregnancies and having several children may produce or exacerbate maternal nutrient deficiencies, which can then compromise the nutritional status of children.²⁵⁵ Birth spacing has been found to reduce maternal nutrient depletion and child undernutrition. For example, an analysis of nationally representative household survey data from El Salvador found that, compared with a birth interval of 36–59 months, birth intervals of less than 24 months and 24–35 months increased the odds of stunting in children by 52 per cent and 30 per cent, respectively.²⁵⁶ A review of the impact of birth spacing on child stunting found that the evidence is inconsistent, with a significant effect not found in all settings.²⁵⁷ However, for settings for which there was a significant effect, a birth interval of at least 36 months reduced stunting by 10–50 per cent.²⁵⁸

Delayed childbearing until at least 20 years of age is also known to reduce child undernutrition because adolescent girls are more likely to give birth to low birthweight infants. There is an association between maternal early age (15–19 years) at first birth and low birthweight in infants, which appears to be independent of confounding factors such as maternal social disadvantage.²⁵⁹

Agricultural development

There is an association between agricultural sector growth and improved nutrition status—an annual investment of US\$8 billion in the agricultural sector would be expected to reduce the number of

²⁵³ P Pridmore and R Carr-Hill, Tackling the drivers of child undernutrition in developing countries: what works and how should interventions be designed? *Public Health Nutrition* 14(4):688–693, 2010.

²⁵⁴ M Lagarde, A Haines and N Palmer, Conditional cash transfers for improving uptake of health interventions in low-and middle-income countries: a systematic review. *JAMA* 298:1900–1910, 2007.

²⁵⁵ United Nations Children's Fund, *Improving child nutrition: the achievable imperative for global progress*

²⁵⁶ JN Gribble, NJ Murray and EP Menotti, Reconsidering childhood undernutrition: can birth spacing make a difference? An analysis of the 2002–2003 El Salvador National Family Health Survey. *Maternal & Child Nutrition* 5(1):49–63, 2009.

²⁵⁷ K Dewey and R Cohen, Does birth spacing affect maternal or child nutritional status? A systematic literature review. *Maternal & Child Nutrition* 3(3):151–173, 2007.

²⁵⁸ Dewey and Cohen

²⁵⁹ Gibbs, Wendt, Peters and Hogue

underweight children globally by 10 million by 2050.²⁶⁰ However, unpacking and explaining this association is challenging.²⁶¹ Complex conceptual linkages exist between agricultural development and child nutrition.²⁶²

Agricultural development is understood to support improved child nutrition in five ways:²⁶³

- › increased consumption of energy and nutrients
- › increased income from the sale of agricultural commodities
- › increased empowerment of women as agents of nutrition-positive agricultural change
- › reduced real food prices due to aggregate increased production
- › increased macroeconomic growth through growth in the agricultural sector.²⁶⁴

However, a recent systematic review found that the complexity of these pathways and the generally weak statistical power of studies of agricultural interventions mean that there is currently insufficiently strong evidence to determine the overall impact of agricultural interventions on child nutrition.²⁶⁵ A review of 19 agricultural development interventions, of which 12 (63 per cent) recorded child nutrition outcomes, found 9 interventions to be associated with improved child nutrition, 2 to be associated with negative impacts on child nutrition and none to be associated with no observed change in child nutrition status.²⁶⁶ These findings are summarised in Annex 2.

Despite the complexity of this evidence base, there is evidence (detailed below) that agricultural development may have a positive impact on child nutrition in three principal ways:

- › increased agricultural productivity
- › increased stability of food production
- › increased control of women over agricultural assets.

Evidence indicates a link between increased food production and improved nutrition.²⁶⁷ Cross-country studies have found a robust association between increased agricultural yields and decreased household poverty,²⁶⁸ or increased household expenditure among the poorest households.²⁶⁹ This association suggests that increased agricultural production improves household food security, which is expected to have a positive impact on nutrition.

²⁶⁰ Hoddinott, Rosegrant and Torero; Ruel and Alderman

²⁶¹ Ruel and Alderman

²⁶² Department for International Development, *The neglected crisis of undernutrition: evidence for action*

²⁶³ World Bank, *From agriculture to nutrition: pathways, synergies and outcomes*

²⁶⁴ World Bank, *From agriculture to nutrition: pathways, synergies and outcomes*

²⁶⁵ Masset, Haddad, Cornelius and Isanza-Castro, *A systematic review of agricultural interventions that aim to improve the nutritional status of children*.

E Masset, L Haddad, A Cornelius and J Isanza-Castro, Effectiveness of agricultural interventions that aim to improve nutritional status of children: systematic review. *BMJ* 344:d8222, 2012.

²⁶⁶ World Bank, *From agriculture to nutrition: pathways, synergies and outcomes*

²⁶⁷ Headey

²⁶⁸ Thirtle, Beyers, Lin, McKenzie-Hill, Irz, Wiggins and Piesse

²⁶⁹ Department for International Development, *An update of 'The neglected crisis of undernutrition: evidence for action'*

In Bangladesh, increased production of rice has been associated with a 15–20 per cent decline in underweight among children aged 6–59 months.²⁷⁰ However, increases in agricultural productivity can have negative impacts on nutrition. For example, agricultural technologies such as irrigation can increase workload and thereby lead to a net decrease in an individual's energy.²⁷¹ Furthermore, where increased productivity is through mono-crops or increased production of nutrient-poor foods, productivity increases will not necessarily improve nutrition.²⁷² Conversely, increased production of diverse and micronutrient-rich foods such as fruits, vegetables and livestock can drive down local prices and deliver improvements in micronutrient status.²⁷³

The majority of acute undernourishment (insufficient dietary energy intake) globally is attributable to a lack of stability in food production across seasons.²⁷⁴ Through improved technology for food production and storage, agricultural development can increase the stability of food availability across seasons and years,²⁷⁵ thereby supporting child nutrition. However, the links are not always well documented because many development programs do not measure nutrition outcome indicators.

Where agricultural development increases women's access to, and control of, agricultural inputs, assets and outputs, there are positive impacts on child nutrition.²⁷⁶ For example, it is estimated that agricultural productivity would increase by approximately 20 per cent in some areas if women had the same access as men to agricultural inputs such as land, seed and fertiliser.²⁷⁷ Evidence indicates that the dissemination of agricultural technologies to women has a greater impact on poverty than providing these technologies to men, which indirectly impacts child nutrition.²⁷⁸

Home gardens

As a recent systematic review has confirmed, the diversity of home gardens means that it is not feasible to generalise about the nutritional impact of all home garden interventions.²⁷⁹ It has been noted that meta-analysis is not an ideal mechanism to synthesise the evidence for the impact of home garden programs.²⁸⁰ However, evidence from individual home garden interventions indicates that some interventions can positively affect child nutrition status. The systematic review identified

²⁷⁰ Department for International Development, *The neglected crisis of undernutrition: evidence for action*

²⁷¹ Department for International Development, *The neglected crisis of undernutrition: evidence for action*

²⁷² Department for International Development, *The neglected crisis of undernutrition: evidence for action*

²⁷³ World Bank, *Environmental health and child survival: epidemiology, economics and experience*

²⁷⁴ Devereux, Vaitla and Hauenstein Swan

²⁷⁵ Masset, Haddad, Cornelius and Isanza-Castro, *A systematic review of agricultural interventions that aim to improve the nutritional status of children*

²⁷⁶ Food and Agriculture Organization of the United Nations, *The state of food insecurity in the world: economic growth is necessary but not sufficient to accelerate reduction of hunger and malnutrition*. P Pridmore and R Carr-Hill, *Addressing the underlying and basic causes of child undernutrition in developing countries: what works and why?*, Evaluation study 2009/2, Ministry of Foreign Affairs of Denmark (Danida), Copenhagen, 2009.

²⁷⁷ International Food Policy Research Institute, *Women: still the key to food and nutrition security*, IFPRI, Washington, DC, 2005.

²⁷⁸ International Food Policy Research Institute

²⁷⁹ Masset, Haddad, Cornelius and Isanza-Castro, *A systematic review of agricultural interventions that aim to improve the nutritional status of children*

²⁸⁰ Bhutta, Das, Rizvi, Gaffey, Walker, Horton, Webb, Lartey and Black

home garden interventions that had led to increased household income and increased consumption of specific fruits and vegetables.²⁸¹

Home garden interventions have also been associated with increased access at the household level to greater quantity and quality of food, increased overall diversity of children's diets, and reduced micronutrient deficiencies in children.²⁸² A home garden program developed by Helen Keller International has increased food availability and improved the micronutrient status of participants, especially women and girls, across several country contexts, although these results have not been observed across all Helen Keller International home garden programs.²⁸³

Home garden interventions can have indirect positive impacts on child nutrition—for example, by supporting women's empowerment and control over resources within the household,²⁸⁴ or by providing a focal point for the integration of agriculture and primary health activities and thus increasing access to health services.²⁸⁵ It is also important to note that home gardens can be more sustainable than other food-based initiatives, such as supplementation or fortification, that rely on sustained external inputs.²⁸⁶

Social protection

Social protection is defined as any policy instrument that seeks to reduce the poverty and vulnerability of individuals and communities, in either the short or long term.²⁸⁷ Social protection can usefully be understood as risk management—that is, preventing households from being exposed to shocks and/or assisting them to cope with shocks.²⁸⁸

Social protection programs are constantly evolving as conceptual approaches to understanding vulnerability and techniques for evaluating and fine-tuning programs develop.²⁸⁹ Social protection is also highly context specific.²⁹⁰ It is therefore challenging to evaluate the evidence for the impact of

²⁸¹ Masset, Haddad, Cornelius and Isanza-Castro, *A systematic review of agricultural interventions that aim to improve the nutritional status of children*

²⁸² L Bhattacharjee, S Kumar and B Nandi, *Food-based nutrition strategies in Bangladesh: experience of integrated horticulture and nutrition development*, Regional Office for Asia and the Pacific, Food and Agriculture Organization of the United Nations, Bangkok, 2007.

²⁸³ Department for International Development, *The neglected crisis of undernutrition: evidence for action*

²⁸⁴ V Bushamuka, S de Pee, A Talukder, L Kiess, D Panagides, A Taher and M Bloem, Impact of a homestead gardening program on household food security and empowerment of women in Bangladesh. *Food and Nutrition Bulletin* 26(1):17–25, 2005.

²⁸⁵ M Faber, M Phungula, S Venter, M Dhansay and A Benadé, Home gardens focusing on the production of yellow and dark green leafy vegetables increase the serum retinol concentrations of 2-5-year-old children in South Africa. *American Journal of Clinical Nutrition* 76:1048–1054, 2002.

²⁸⁶ DH Galhena, R Freed and KM Maredia, Home gardens: a promising approach to enhance household food security and wellbeing. *Agriculture & Food Security* 2:8, 2013.

²⁸⁷ Department for International Development, *An update of 'The neglected crisis of undernutrition: evidence for action'*; United Nations Development Programme, *Exploring the role of social protection in enhancing food security in Africa*

²⁸⁸ United Nations Development Programme, *Exploring the role of social protection in enhancing food security in Africa*

²⁸⁹ United Nations Development Programme, *Exploring the role of social protection in enhancing food security in Africa*

²⁹⁰ Department for International Development, *The neglected crisis of undernutrition: evidence for action*

social protection on child nutrition. Overall, however, most evaluations of the nutrition impact of social protection programs have found a positive impact.²⁹¹ Indeed, many broad social protection programs have a more positive impact on child nutrition status than nutrition-specific programs that operate at a community level.²⁹²

Evidence for the impact of several specific social protection programs is summarised below. Programs were selected on the basis of their inclusion in a recent review of social protection programs prepared by the High Level Panel of Experts on Food Security and Nutrition of the United Nations Committee on World Food Security.²⁹³ The decision to draw from the work of the panel was designed to align this report's approach to social protection with the consensus of leading global experts. However, it is important to note that this approach may have biased the findings of this review.

Input subsidies have been used to reduce the price of agricultural inputs to producers, in order to promote household food security in the short term and agricultural productivity in the long term. In the case of Malawi, mentioned above (under 'Contributing factors at the institutional level'), government subsidies for fertilisers and hybrid maize seeds generated a rapid increase in agricultural productivity and food availability at the national level.²⁹⁴ However, a recent review of the impact of input subsidies found that, although they tend to reduce rural poverty and increase food security at the household and national level, they are very expensive to maintain, disproportionately benefit non-poor producers and can have negative impacts on domestic markets.²⁹⁵ For these reasons, input subsidies are not considered to be an appropriate intervention to promote nutrition security.²⁹⁶

Crop and livestock insurance is used to support households to make high-risk, high-return investments that will have positive impacts on household food security and household members' nutrition status—for example, planting high-yield crops that are sensitive to variations in rainfall.²⁹⁷ A recent review found no evidence for the impact of these schemes on nutrition.²⁹⁸

Public works programs provide paid work to the poor in exchange for labour on public infrastructure; this is designed to support household food security by supplementing and stabilising income. A large public works program in Maharashtra state, India, has been evaluated as stabilising income in rural

²⁹¹ Department for International Development, *The neglected crisis of undernutrition: evidence for action*

²⁹² D Sridhar and A Duffield, *A review of the impact of cash transfer programmes on child nutritional status and some implications for Save the Children UK programmes*, Save the Children, London, 2006.

²⁹³ High Level Panel of Experts, *Social protection for food security: a report by the High Level Panel of Experts on Food Security and Nutrition*

²⁹⁴ Denning, Kabambe, Sanchez, Malik, Flor, Harawa, Nkhoma, Zamba, Banda, Magombo, Keating, Wangila and Sachs

²⁹⁵ High Level Panel of Experts *Social protection for food security: a report by the High Level Panel of Experts on Food Security and Nutrition*

²⁹⁶ High Level Panel of Experts, *Social protection for food security: a report by the High Level Panel of Experts on Food Security and Nutrition*

²⁹⁷ Rosenzweig and Binswanger

²⁹⁸ High Level Panel of Experts, *Social protection for food security: a report by the High Level Panel of Experts on Food Security and Nutrition*

households throughout the year and reducing undernutrition within participating households.²⁹⁹ This program is recognised as an example of best practice.³⁰⁰

However, not all public works programs have a positive nutritional impact. In particular, the energy expended performing manual labour is known to reduce the net nutritional impact of the food or cash wages received;³⁰¹ one evaluation of a program in Niger found lower body mass index scores for participants than for nonparticipants in the same household,³⁰² although this may be confounded by intrahousehold power dynamics.

A recent review of the nutritional impact of **food subsidies** found that generalised food subsidies, available to the entire population, can increase the consumption of staple foods but are inefficient in that they tend to benefit richer households more than poorer households.³⁰³ The alternative approach of providing targeted food subsidies to pre-identified recipients has been found to have a high risk of corruption and leakage of subsidies to the non-poor, as well as high administrative costs.³⁰⁴ For example, a targeted food subsidy program in India cost nearly six rupees for each one rupee (or equivalent) of income transferred to participating households.³⁰⁵

School feeding programs can have direct impacts on the nutrition status of participating children and households. For example, a school snack program in the Philippines increased the calorie consumption of primary-school children by 300 kcal per person per day.³⁰⁶ A supplementary feeding program in Uganda found a significant decline in the prevalence of anaemia for children aged 10–13 years, as well as women aged over 18 years, in participating households.³⁰⁷

Evidence from Bangladesh shows the positive nutrition impacts of take-home rations delivered through a school feeding program on household members, particularly younger siblings.³⁰⁸ However, these impacts are typically small.³⁰⁹ Furthermore, school feeding programs reach school children too

²⁹⁹ D Sjoblom and J Farrington, *The Indian National Rural Employment Guarantee Act: will it reduce poverty and boost the economy?*, ODI project briefing 7, Overseas Development Institute, London, 2008.

³⁰⁰ United Nations Children's Fund, *Improving child nutrition: the achievable imperative for global progress*

³⁰¹ High Level Panel of Experts, *Social protection for food security: a report by the High Level Panel of Experts on Food Security and Nutrition*

³⁰² P Webb, Employment programs for food security in rural and urban Africa: experiences in Niger and Zimbabwe. In: *Employment for Poverty Reduction and Food Security*, J von Braun (ed), International Food Policy Research Institute, Washington, DC, 1995.

³⁰³ High Level Panel of Experts, *Social protection for food security: a report by the High Level Panel of Experts on Food Security and Nutrition*

³⁰⁴ High Level Panel of Experts, *Social protection for food security: a report by the High Level Panel of Experts on Food Security and Nutrition*

³⁰⁵ R Radhakrishna and K Subbarao, *India's Public Distribution System: a national and international perspective*, discussion paper 380, World Bank, Washington, DC, 1997.

³⁰⁶ H Jacoby, Is there an intrahousehold 'flypaper effect'? Evidence from a school feeding programme. *Economic Journal* 112:196–221, 2002.

³⁰⁷ Adelman, Gilligan, Konde-Lule and Alderman

³⁰⁸ A Ahmed, *Impact of feeding children in school: evidence from Bangladesh*, International Food Policy Research Institute, Washington, DC, 2004.

³⁰⁹ Food and Agriculture Organization of the United Nations, *The state of food insecurity in the world: economic growth is necessary but not sufficient to accelerate reduction of hunger and malnutrition*

late to reverse any stunting that has already occurred during pregnancy and the first 2 years of life. A 2007 Cochrane review found school feeding to increase body mass index but not reduce stunting,³¹⁰ while the *Lancet* 2008 series found that evidence showed little or no effect of preschool feeding programs on child undernutrition.³¹¹ As most school feeding is done in primary schools, the effects on adolescent nutritional status have not been studied.

Conditional cash transfers are payments made to families for an action that is generally relevant to child health or nutrition, such as the vaccination of children.³¹² A Cochrane review of conditional cash transfers found them to have a positive impact on the use of health services, and nutrition and health outcomes.³¹³ Evaluations of the impact of conditional cash transfers on household food security have found a positive effect that is stronger in poorer households—the poorest 30 per cent of participating households in three programs had increased calorie intake by 5.8–12.7 per cent.³¹⁴ Reviews of the impact of conditional cash transfers on child nutrition status have found an impact on stunting, although this effect is not observed consistently in all evaluated programs.³¹⁵

Social transfers, also known as unconditional cash transfers, are regular and predictable cash transfers targeted to poor and vulnerable households or individuals.³¹⁶ Evidence indicates that social transfers improve energy and nutrient intake. An evaluation of a social transfer program in Ethiopia found that three-quarters of participants consumed a better quantity and quality of food than in the previous year.³¹⁷ A scheme in Zambia is associated with increased consumption of fats, proteins and vitamins among beneficiaries, and a decline of households living on one meal per day from 19 per cent to 13 per cent.³¹⁸

Evidence also indicates that social transfers improve child nutrition in participating households. Children who are beneficiaries of a social transfer in South Africa have reduced stunting, such that

³¹⁰ E Kristjansson, V Robinson, M Petticrew, B MacDonald, J Krasevec, L Janzen, T Greenhalgh, G Wells, J MacGowan, A Farmer, B Shea, A Mayhew and P Tugwell, School feeding for improving the physical and psychosocial health of disadvantaged elementary school children. *Cochrane Database of Systematic Reviews* 1:CD004676, 2007.

³¹¹ Bhutta, Ahmed, Black, Cousens, Dewey, Giugliani, Haider, Kirkwood, Morris, Sachdev and Shekar

³¹² Bhutta, Ahmed, Black, Cousens, Dewey, Giugliani, Haider, Kirkwood, Morris, Sachdev and Shekar

³¹³ M Lagarde, A Haines and N Palmer, The impact of conditional cash transfers on health outcomes and use of health services in low and middle income countries (review). *Cochrane Database of Systematic Reviews* 4:CD008137, 2009.

³¹⁴ J Hoddinott and D Weisnann, The impact of conditional cash transfer programs on food consumption. In: *Conditional cash transfers in Latin America*, M Adato and J Hoddinott (eds), Johns Hopkins University Press, Baltimore, 2010.

³¹⁵ Department for International Development, *An update of 'The neglected crisis of undernutrition: evidence for action'*

³¹⁶ Department for International Development, *The neglected crisis of undernutrition: evidence for action*; Department for International Development, *An update of 'The neglected crisis of undernutrition: evidence for action'*

³¹⁷ Department for International Development, *The neglected crisis of undernutrition: evidence for action*

³¹⁸ Ministry of Community Development and Social Services and German Technical Cooperation, *Evaluation report: Kalomo Social Cash Transfer Scheme*, Ministry of Community Development and Social Services, Lusaka, 2006.

they are anticipated to be 3.5 cm taller as adults.³¹⁹ A social transfer program in Malawi that has been rigorously evaluated is associated with a 9 per cent reduction in child stunting in beneficiary households in one year, compared with no change in control households.³²⁰

Furthermore, evidence suggests that social transfers assist households to make investments that benefit nutrition.³²¹ For example, consumption among beneficiaries of a social transfer program in Bolivia increased by twice the amount of the benefit, which suggests that the transfer facilitated investment with positive nutritional impacts.³²² Importantly, there is some evidence that social transfers have a greater positive impact on child nutrition when they are delivered to women rather than men.³²³

Social protection operates to reduce the vulnerability of individuals and households to the risk factors for undernutrition, but in general has little capacity to directly address these risk factors.³²⁴ Consequently, the impact of social protection on child undernutrition is greatest when these mechanisms are delivered as part of a comprehensive, integrated approach; this is referred to as a social protection system.³²⁵

For example, a program in Bangladesh has effectively supported household nutrition security by reducing extreme poverty in participating households by 30 per cent over 4 years, and has increased the energy intake at household level from 1632 kcal per person per day to 2236 kcal per person per day, well above the minimum requirement. This success has been attributed to the program being integrated across sectors and acting on multiple areas, such as social protection, agricultural productivity and education.³²⁶

Interventions addressing key contributing factors

This section provides a brief summary of interventions to address key contributing factors that can expose households at risk to the proximal and distal causal factors for child undernutrition, such as female illiteracy, gender inequity, poor governance and poverty.

³¹⁹ J Agüero, M Carter and I Woolard, *The impact of unconditional cash transfers on nutrition: the South African child support grant*, working paper 39, International Poverty Centre, United Nations Development Programme, New York, 2007.

³²⁰ C Miller, M Tsoka and K Reichert, Impacts on children of cash transfers in Malawi. In: *Social protection for Africa's children*, S Handa, S Devereux and D Webb (eds), Routledge, London, 2011.

³²¹ United Nations Development Programme, *Exploring the role of social protection in enhancing food security in Africa*

³²² International Labour Organization, *Extending social security to all: a guide through challenges and options*, ILO, Geneva, 2010.

³²³ R Sabates-Wheeler and N Kabeer, *Gender equality and the extension of social protection*, Extension of social security paper 16, International Labour Organization, Geneva, 2003.

³²⁴ High Level Panel of Experts, *Social protection for food security: a report by the High Level Panel of Experts on Food Security and Nutrition*

³²⁵ High Level Panel of Experts, *Social protection for food security: a report by the High Level Panel of Experts on Food Security and Nutrition*

³²⁶ EuropeAid, *Social transfers in the fight against hunger: a resource for development practitioners*, Tools and Methods Series: European Commission reference document, European Commission, Brussels, 2012.

Improved women's education

Improved women's education comprises both increased participation in formal schooling (e.g. schooling duration or level of educational attainment) and improved educational outcomes (e.g. literacy).

There is a well-established relationship between educational attainment of women and girls, literacy and child nutrition, although analyses of this relationship can be confounded by income.³²⁷

A multicountry analysis suggests that 43 per cent of the total reduction in child undernutrition between 1970 and 1995 was attributable to improvements in women's education.³²⁸ A review of data from 25 countries indicates that 1–3 years of maternal schooling reduces child mortality by 15 per cent.³²⁹ Literate mothers are more likely to access health services, understand health promotion messages and have the confidence to ask questions of health workers. Given that more than half of child deaths in developing countries are attributable to undernutrition,³³⁰ maternal schooling can be understood to have a protective effect on child nutrition.

Countrywide household surveys in India, Pakistan and Sri Lanka confirm the positive impact of maternal education on child nutrition. Analysis of these data indicates that illiterate mothers are associated with the highest incidence of child undernutrition in each country; women who have completed only primary schooling had up to 20 per cent less undernutrition among their children.³³¹

Women's increased control over assets

Evidence indicates that women's control over assets is a key pathway through which the status of women is correlated with child nutrition status. There is a strong body of evidence that interventions that increase women's status and control over assets have positive impacts on child nutrition status.³³² For example, a study of a microfinance program in Ethiopia found that children of female clients had significantly better nutrition status and household food security than children of male clients and controls; male clients and controls had roughly similar levels of reliance on food aid.³³³ A study in Sri Lanka found that household food consumption is more diversified, which can be expected

³²⁷ Pridmore and Carr-Hill, *Public Health Nutrition*

³²⁸ L Smith and L Haddad, *Explaining child malnutrition in developing countries: a cross country analysis*, research report 111, International Food Policy Research Institute, Washington, DC, 2000.

³²⁹ Ramachandran, *Women and food security in South Asia*

³³⁰ L Caulfield, M de Onis, M Blössner and R Black, Undernutrition as an underlying cause of child deaths associated with diarrhea, pneumonia, malaria, and measles. *American Journal of Clinical Nutrition* 80(1):193–198, 2004.

D Pelletier, E Frongillo, D Schroeder and J Habicht, The effects of malnutrition on child mortality in developing countries. *Bulletin of the World Health Organization* 73:443–448, 1995.

³³¹ N Ramachandran, *Underfed, underpaid, overlooked: women, the key to food security in South Asia*, Gatekeeper 136, International Institute for Environment and Development, London, 2008.

³³² Pridmore and Carr-Hill, *Addressing the underlying and basic causes of child undernutrition in developing countries: what works and why?*

³³³ S Doocy, S Teferra, D Norell and G Burnham, Credit program outcomes: coping capacity and nutritional status in the food insecure context of Ethiopia. *Social Science & Medicine* 60(10):2371–2382, 2005.

to have positive nutrition impacts, when women have more control over household income.³³⁴ Furthermore, there is a broad body of evidence that increasing women's control over resources has a positive effect on family and household welfare, and that this positive effect is particularly strong for child health and nutrition.³³⁵

Strengthened governance and political leadership

There is a well-established link between good governance and child nutrition.³³⁶ A study of 82 countries found a strong correlation between higher government effectiveness, political stability and rule of law, and lower child undernutrition.³³⁷

Recently, several in-depth analyses of country experiences using governance interventions to address child undernutrition have developed an evidence base for the impact of governance on child nutrition.³³⁸ Based on this evidence, strong national leadership and political will, a multisectoral approach with institutionalised linkages between sectors, vertical integration, sustained funding, a plan that connects short- and long-term interventions, and effective accountability mechanisms, including civil society participation, create an enabling environment in which effective action on child undernutrition is more likely.

These interventions can have a substantial impact on child undernutrition. For example, the rapid reductions in child undernutrition in Thailand have been largely attributed to a supportive policy environment. This includes a comprehensive multisectoral nutrition policy, and effective integration of short- and long-term nutrition priorities within national development planning.³³⁹ In Brazil, a focused nutrition agenda under the direct control of the president contributed to a reduction in the prevalence of child underweight from 13 per cent in 1994 to 1.7 per cent in 2006.³⁴⁰

Macroeconomic development

Economic growth in itself does not have a substantial impact on child undernutrition. On average, the prevalence of child undernutrition declines at half the rate of increases in gross national product per capita; this is four times slower than the decline in poverty rates.³⁴¹ Indeed, in several countries, including India and Egypt, rapid economic growth has produced little or no reduction in

³³⁴ S Sandström and L Tchatchua, Do cash transfers improve food security in emergencies? Evidence from Sri Lanka. In: *Revolution: From food aid to food assistance—innovations in overcoming hunger*, S Omamo, U Gentilini and S Sandström (eds), World Food Programme, Rome, 2010.

³³⁵ Food and Agriculture Organization of the United Nations, *The state of food insecurity in the world: economic growth is necessary but not sufficient to accelerate reduction of hunger and malnutrition*

³³⁶ Pridmore and Carr-Hill, *Public Health Nutrition*

³³⁷ Rokx

³³⁸ Haddad, Acosta and Fanzo; CA Monteiro, MHDA Benicio, WL Conde, S Konno, AL Locadino, AJ Barros and CG Victora, Narrowing socioeconomic inequality in child stunting: the Brazilian experience, 1974–2007. *Bulletin of the World Health Organization* 88:305–311, 2010.
Rokx; Sanchez-Montero, Ubach and Sullivan, *Undernutrition: what works? A review of policy and practice*; Sullivan, Lort-Phillips and Tinoco

³³⁹ Ruel

³⁴⁰ Sullivan, Lort-Phillips and Tinoco

³⁴¹ Department for International Development, *The neglected crisis of undernutrition: evidence for action*

malnutrition.³⁴² However, economic growth in the context of macroeconomic policy reform has been associated with rapid improvements in child health and nutrition.³⁴³

An extensive cross-country econometric analysis found that macroeconomic development drives improvements in child nutrition when it leads to increased food production, reduced poverty, increased female educational attainment, improved access to health services and reduced fertility rates.³⁴⁴ This relationship between what Headey³⁴⁵ terms ‘nutrition-sensitive growth’ and child nutrition has been clearly displayed in China³⁴⁶ and Thailand,³⁴⁷ where economic development has led to rapid improvements in child nutrition status.

Cost-effectiveness

The cost-effectiveness of nutrition-specific interventions has been well addressed in the literature. However, the cost-effectiveness of nutrition-sensitive interventions is substantially more challenging to calculate. Annex 1 provides detailed estimates of the cost-effectiveness of nutrition-specific and, where feasible, nutrition-sensitive interventions. It is important to note that Annex 1 draws together estimates of the cost–benefit ratio and cost-effectiveness of nutritional interventions from a range of sources. These sources use a variety of key assumptions to accommodate uncertainties in factors such as food production and utilisation, program coverage rate, treatment-seeking behaviour, outcomes at various stages of the project cycle, acceptance of the program within the target population and cost per unit of analyses. These assumptions vary across regions, study types and study designs, and the comparison of cost-effectiveness across studies—while useful—should be treated with caution.

The Copenhagen Consensus Centre, a United States–based think-tank that ‘publicises the best ways for governments and philanthropists to spend aid and development money’, has attempted to rank the cost-effectiveness of development interventions in its Copenhagen Consensus 2012. The top-ranked investment is ‘interventions to reduce chronic undernutrition in preschoolers’, a package of interventions including micronutrient supplements, complementary feeding, deworming, therapeutic treatment for diarrhoea, and nutrition counselling or behaviour change.³⁴⁸ This integrated package of nutrition-specific interventions was ranked highest because of its very high cost–benefit ratio—an investment of approximately US\$100 per child was calculated to reduce child undernutrition by 36 per cent, equating to a cost–benefit ratio of 1:30 or more.³⁴⁹ Its approach focuses on the synergy between nutrition and economic development to recommend investment in child nutrition.

³⁴² Headey

³⁴³ Department for International Development, *The neglected crisis of undernutrition: evidence for action*

³⁴⁴ Headey

³⁴⁵ Headey

³⁴⁶ Bryce, Coitinho, Darnton-Hill, Pelletier, Pinstrup-Andersen and Maternal and Child Undernutrition Study Group

³⁴⁷ Ruel

³⁴⁸ *Expert Panel findings*, Copenhagen Consensus 2012, Copenhagen Consensus Center, Copenhagen, Denmark, 2012.

³⁴⁹ *Expert Panel findings*

Part II

Contemporary policy thinking and approaches to nutrition

6 The historical development of policy thinking and strategies at a global level

Table 3 Key global summits, frameworks and literature relevant to child undernutrition

1974	World Food Conference identifies food production as the solution to world hunger
1979	Convention on the Elimination of All Forms of Discrimination Against Women protects women's right to adequate nutrition during pregnancy and breastfeeding
1989	Convention on the Rights of the Child identifies children's right to food, health and care
1991	Ending Hidden Hunger Conference focuses on micronutrient malnutrition
1992	International Conference on Nutrition, the first global intergovernmental conference on nutrition, advocates integrating nutrition objectives into general development programming and addressing nutritional vulnerability^a
1996	World Food Summit calls for food and nutrition security for all
2000	Millennium Development Goal 1 calls for a 50% reduction in child underweight
2001	World Food Summit + 5 focuses on agricultural development and food production
2002	A World Fit for Children, a UN special session, draws attention to the intergenerational cycle of undernutrition and poor health
2003	Global Strategy for Infant and Young Child Feeding focuses on feeding and care
2004	FAO Member Countries adopt voluntary guidelines on national food security
2006	World Bank publishes <i>Repositioning nutrition as central to development</i> , identifying synergy between nutrition and economic development
2006	UN Standing Committee on Nutrition annual session focuses on the double burden of malnutrition
2007	REACH adopts a multisectoral, multi-stakeholder approach to child undernutrition
2008	<i>The Lancet</i> maternal and child undernutrition series 2008 identifies a set of direct interventions targeting the immediate causes of child undernutrition
2008	Copenhagen Consensus 2008 identifies zinc and vitamin A supplementation as the best global development investment
2008–09	Global food price crisis brings attention to food production and supply systems³⁵⁰
2009	Rome Principles for Sustainable Food Security address governance of the global food system
2009	L'Aquila Food Security Initiative mobilises resources for agricultural development and social protection to support food security
2010	UN High Level Task Force on the Global Food Security Crisis focuses on nutrition security for vulnerable populations
2010	1,000 Days Partnership advocates action in the first 1000 days
2010	SUN Road Map is released, focusing on country ownership, coordination and a twin-track approach
2012	Copenhagen Consensus 2012 identifies bundled micronutrient interventions as the best global development investment
2012	65th World Health Assembly adopts the Maternal, Infant and Young Child Nutrition Comprehensive Implementation Plan, which targets stunting, anaemia in women of reproductive age, low birth weight, childhood

³⁵⁰ E Kennedy, P Webb, P Walker, E Saltzman, D Maxwell, M Nelson and S Booth, The evolving food and nutrition agenda: policy and research priorities for the coming decade. *Food and Nutrition Bulletin* 32(1):60–68, 2011.

	overweight, exclusive breastfeeding, and wasting
2012	SUN Revised Road Map and SUN Movement Strategy are released, re-emphasising country ownership, coordination and a twin-track approach , and identifying governance and alignment as key strategic approaches to address undernutrition
2013	<i>The Lancet</i> Maternal and Child Nutrition Series 2013 includes the double burden of malnutrition , and identifies an enabling environment, nutrition-sensitive and nutrition-specific approaches as requisite for effective action on undernutrition

FAO = Food and Agriculture Organization of the United Nations; REACH = Renewed Efforts Against Child Hunger and Undernutrition; SUN = Scaling Up Nutrition; UN = United Nations

a The conference also addressed household food security, breastfeeding, the negative impacts of disease on child nutrition status, and micronutrient deficiencies.

At a global level, policy thinking and strategies relevant to child undernutrition have been characterised by diversity and changes in emphasis, as outlined in Table 3. However, it is possible to identify four components of contemporary policy thinking and approaches to child undernutrition that have emerged from this diverse history. These components have informed the Scaling Up Nutrition (SUN) Movement, which is recognised as the current global consensus on how best to approach child undernutrition.³⁵¹

- › Contemporary policy thinking is characterised by an increasingly strategic approach to child undernutrition. Current thinking has shifted from a primary focus on nutrition-specific interventions, such as micronutrient supplements, to encompass systems-based approaches targeting distal risk factors.³⁵² This twin-track approach, advocated by the SUN Movement, focuses on distal risk factors operating at household, national and global levels as much as on proximal risk factors. It also pays greater attention to implementation and operational issues.³⁵³
- › There has been a longstanding focus on the relationship between food security, rural and agricultural development, and nutrition. Conceptual understanding of this relationship has developed from a focus on food production, to food security, to the current emphasis on food systems.³⁵⁴ Using food systems to support nutrition is a key focus area for current policy thinking.
- › Following the 2008–09 food price crisis, the global community has focused increasingly on the concept of nutritional vulnerability to shocks, including food price shocks. Currently, increased attention is paid to risk management, and the linkages between nutrition and social protection interventions.³⁵⁵
- › A major recent shift in thinking about nutrition has been the increased attention paid to governance. Governance did not feature on the child undernutrition agenda as late as 2007,³⁵⁶ but now informs approaches to child undernutrition at the national and global level; for example, governance is central to the SUN Movement's focus on coordination and country ownership.

³⁵¹ MB Duggan, The elephant moves into the sunlight: progress in child malnutrition. *Paediatrics and International Child Health* 32(4):190–203, 2012.

³⁵² Kennedy, Webb, Walker, Saltzman, Maxwell, Nelson and Booth

³⁵³ P Webb, *Achieving food and nutrition security: lessons learned from the Integrated Food Security Programme (IFSP)*, Mulanje, Malawi, Feinstein International Centre, Boston, 2011.

³⁵⁴ Kennedy, Webb, Walker, Saltzman, Maxwell, Nelson and Booth; A Dangour, Z Diaz, M Connolly, I Miller and J Lam, *Nutrition advocacy: building opportunities in Europe*, London School of Hygiene & Tropical Medicine, London, 2011.

³⁵⁵ Kennedy, Webb, Walker, Saltzman, Maxwell, Nelson and Booth

³⁵⁶ A Sumner, J Lindstrom and L Haddad, *Greater DFID and ED leadership on chronic malnutrition: opportunities and constraints*, Institute of Development Studies, Brighton, 2007.

7 Key multilateral organisations

United Nations Standing Committee on Nutrition

The United Nations Standing Committee on Nutrition (UN SCN) is the peak UN body for nutrition. Its mandate is to harmonise food and nutrition policies within the UN family, and to promote coordination and cooperation in approaches to malnutrition, including child undernutrition, among UN agencies and partner organisations, including country governments.³⁵⁷ Nutrition is framed as a development issue, with undernutrition a barrier to human development.³⁵⁸ This conceptualisation of undernutrition entails a very broad focus on nutrition, which includes proximal and distal risk factors across all sectors.³⁵⁹

UN SCN actions are focused on governance and multisectoral, multi-stakeholder coordination.³⁶⁰ The organisation also supports the integration of nutrition considerations into broader development activities—that is, nutrition-sensitive development.³⁶¹ Although not an operational agency, UN SCN provides leadership and plays a critical role within the Scaling Up Nutrition (SUN) framework.

World Health Organization

The World Health Organization (WHO) is a technical agency that is responsible for developing standards, guidelines and operational norms. The agency has a strong focus on nutrition as a child health issue. Nutrition is framed in terms of individual health outcomes and immediate causes of undernutrition affecting the child and mother, including stunting, wasting, low birthweight, maternal anaemia, exclusive breastfeeding and appropriate complementary feeding.³⁶² The focus of nutrition action is the mother–child dyad, with a life cycle approach taken to maternal nutrition and health.³⁶³

³⁵⁷ United Nations Standing Committee on Nutrition, *UNSCN mandate*, SCN, accessed 16 May 2013, www.unscn.org/en/mandate.

³⁵⁸ United Nations Standing Committee on Nutrition, *Strategic framework 2006–2010*, SCN Secretariat, Geneva, 2006.

³⁵⁹ R Longhurst, *Global leadership for nutrition: the UN's Standing Committee on Nutrition (SCN) and its contributions*, IDS discussion paper 390, Institute of Development Studies, Brighton, 2010.

³⁶⁰ United Nations Standing Committee on Nutrition, *Strategic framework 2006–2010*

³⁶¹ United Nations Standing Committee on Nutrition, *Strategic framework 2006–2010*

³⁶² World Health Organization, *Global targets 2025: to improve maternal, infant and young child nutrition*, WHO, accessed 9 May 2013, www.who.int/nutrition/topics/nutrition_globaltargets2025/en/index.html.

³⁶³ World Health Organization, *10 facts on nutrition*, WHO, accessed 9 May 2013, www.who.int/features/factfiles/nutrition/en/index.html#.

Nutrition is described as the result of food intake, micronutrient intake, health status and care.³⁶⁴ This entails a focus on the proximal causes of child undernutrition.

The focus of actions is within the 1000 days covering pregnancy and the first 2 years of life. There is a major focus on promoting, protecting and supporting breastfeeding as a critical nutrition action,³⁶⁵ and on infant and young child feeding more broadly.³⁶⁶ A supplementary, specific focus is on micronutrient intake.³⁶⁷ WHO also provides technical guidelines for facility- and community-based management of severe acute malnutrition.³⁶⁸ Although WHO publications recognise the longer-term causes of child undernutrition, recommendations for action are made on the basis of the strength of the evidence for specific interventions.³⁶⁹ Consequently, recommendations for 'essential nutrition actions' are for nutrition-specific interventions targeting mothers and children, for which there is a stronger evidence base than for nutrition-sensitive interventions that have longer causal chains.³⁷⁰

UNICEF

The United Nations Children's Fund (UNICEF) positions nutrition as a critical component of its 'child survival and development' focus area.³⁷¹ UNICEF is an operational agency and, like WHO, has a major influence on national policies. Australia is a major donor to UNICEF, especially in the Asia-Pacific region, and is in a position to influence policies and program performance. Nutrition is given a similar priority to the themes of disability, early childhood development and immunisation;³⁷² it is considered to be an essential part of child health. Nutrition is described as the outcome of energy and micronutrient intake, health and care,³⁷³ which supports a focus on proximal risk factors for child undernutrition. UNICEF also has an explicit focus on the rights of women and girls, which supports a life cycle approach to maternal nutrition and a focus on intergenerational causes of child undernutrition.³⁷⁴

UNICEF takes a twin-track approach to nutrition programming, covering both nutrition-specific and nutrition-sensitive approaches. Nutrition-specific interventions that target children cover infant and young child feeding, micronutrients, nutrition security in emergencies (e.g. supplementary feeding), and nutrition and HIV/AIDS.³⁷⁵ Nutrition-specific interventions also target mothers, through programs

³⁶⁴ World Health Organization, *10 facts on nutrition*

³⁶⁵ World Health Organization, *Global targets 2025: to improve maternal, infant and young child nutrition*; World Health Organization, *10 facts on breastfeeding*, WHO, accessed 9 May 2013, www.who.int/features/factfiles/breastfeeding/en/index.html#.

³⁶⁶ World Health Organization, *10 facts on nutrition*

³⁶⁷ World Health Organization, *10 facts on nutrition*

³⁶⁸ World Health Organization, *Severe acute malnutrition*, WHO, accessed 10 July 2013, www.who.int/nutrition/topics/malnutrition/en/.

³⁶⁹ World Health Organization, *e-Library of evidence for nutrition actions (eLENA)*

³⁷⁰ World Health Organization, *e-Library of evidence for nutrition actions (eLENA)*

³⁷¹ M Di Ciommo, *The aid financing landscape for nutrition*, Development Initiatives, 2013.

³⁷² United Nations Children's Fund, *Nutrition: the big picture*, accessed 8 May 2013, www.unicef.org/nutrition/index_bigpicture.html.

³⁷³ United Nations Children's Fund, *Nutrition: the big picture*

³⁷⁴ United Nations Children's Fund, *Nutrition: the big picture*

³⁷⁵ United Nations Children's Fund, *Nutrition: the big picture*

to prevent low birthweight, such as multiple micronutrient supplementation.³⁷⁶ Nutrition-sensitive interventions address the distal risk factors for maternal undernutrition and poor health, predominantly through programs targeting women's education, workload and emotional wellbeing, as well as their physical health and nutrition status.³⁷⁷

Food and Agricultural Organization of the United Nations

The Food and Agricultural Organization of the United Nations (FAO) takes a food-based approach to nutrition.³⁷⁸ Nutrition is conceptualised through its linkages with food and agriculture,³⁷⁹ using the central organising concept of food security.³⁸⁰ Importantly, while the FAO recognises that health status and care affect nutrition status, these are conceptualised as mediating rather than causal factors; food security is conceptualised as the dominant cause of undernutrition.³⁸¹ Nutrition is framed at a population level, with no strong, specific focus on child undernutrition.³⁸² Women, as a population group, are considered important for their role in food production and preparation, but maternal nutrition as an intergenerational cause of child undernutrition is not directly considered.³⁸³ The FAO identifies nutrition as central to the achievement of broader development goals, and engages with the complex feedback loops between agricultural development, food and nutrition status; however, these analyses are primarily focused on food security rather than on nutrition.

The majority of FAO nutrition actions involve food production and agriculture to increase the production, nutrient density and bioavailability of food, including home gardens, small livestock production, and education and technological development to improve food preservation.³⁸⁴ The FAO thus addresses the availability and utilisation dimensions of food security. It also targets the accessibility dimension of food security through a focus on food supply systems—for example, through increasing market access to affordable food.³⁸⁵

World Food Programme

Under its 2008–2013 Strategic Plan, the World Food Programme (WFP) renewed its broad focus on nutrition.³⁸⁶ Tackling hunger and undernutrition is now a strategic objective.³⁸⁷ Nutrition is framed in

³⁷⁶ United Nations Children's Fund, *Nutrition: the big picture*

³⁷⁷ United Nations Children's Fund, *Nutrition: the big picture*

³⁷⁸ Food and Agriculture Organization of the United Nations, *Nutrition*, FAO, accessed 9 May 2013, www.fao.org/food/en.

³⁷⁹ B Thompson and L Amoroso, *FAO's approach to nutrition-sensitive agricultural development*, Food and Agriculture Organization of the United Nations, Rome.

³⁸⁰ Food and Agriculture Organization of the United Nations, *Nutrition*

³⁸¹ B Thompson, L Amoroso and J Meerman, *Promoting the expression 'food and nutrition security (FNS)'*, Strategy note, Nutrition and Consumer Protection Division - AGN, Food and Agriculture Organization of the United Nations, Rome.

³⁸² Thompson, Amoroso and Meerman

³⁸³ Thompson and Amoroso; Thompson, Amoroso and Meerman

³⁸⁴ Food and Agriculture Organization of the United Nations, *Nutrition*

³⁸⁵ Food and Agriculture Organization of the United Nations, *Nutrition*

³⁸⁶ World Food Programme, *Mid-term review of the WFP strategic plan (2008–2013)*, Executive Board annual session, Rome, 4–8 June 2012, WFP, Rome, 2012.

terms of energy and nutrient intake; since 2008, nutrient intake has been established as a key component of WFP thinking.³⁸⁸ Additionally, the WFP has recently expanded to address nutrition security, applying a social protection framework to design interventions that build resilience to food shocks.³⁸⁹

The WFP recognises that the causes of undernutrition cover multiple sectors, but focuses its activities on food-based approaches to nutrition.³⁹⁰ Most actions target food intake, a proximal risk factor for undernutrition, through direct, nutrition-specific interventions,³⁹¹ such as the provision of ready-to-use micronutrient-fortified powder to households.³⁹² The WFP also implements school feeding programs in a number of countries in the Asia–Pacific region. Activities designed to promote nutrition security integrate food distribution with social protection mechanisms, such as cash or voucher schemes; however, activities under this integrated, social protection–focused approach are still developing and at this stage reach only a small minority of program beneficiaries.³⁹³

³⁸⁷ World Food Programme

³⁸⁸ World Food Programme

³⁸⁹ World Food Programme

³⁹⁰ World Food Programme, *WFP nutrition policy*, Executive Board first regular session, Rome, 13–15 February 2012, WFP, Rome, 2012.

³⁹¹ World Food Programme

³⁹² Di Ciommo

³⁹³ World Food Programme, *Mid-term review of the WFP strategic plan (2008–2013)*

8 Joint and global approaches to nutrition

Facts for life

Facts for life is a publication issued jointly by the United Nations Children's Fund (UNICEF); the World Health Organization (WHO); the United Nations Educational, Scientific and Cultural Organization (UNESCO); the United Nations Population Fund; the United Nations Development Programme; the Joint United Nations Programme on HIV/AIDS (UNAIDS); the World Food Programme (WFP); and the World Bank.³⁹⁴ It presents a broad, global consensus on topics relevant to child health and development. The most recent edition was published in 2010.³⁹⁵

Nutrition is conceptualised in terms of its impacts on child growth. The 2010 edition frames undernutrition as the result of energy and nutrient deficiencies.³⁹⁶ The focus is on the mother–child dyad, with mothers and children seen as very closely linked in terms of nutrition interventions and outcomes.³⁹⁷ Household food insecurity, and poor access to water, sanitation and hygiene at a household level are described as the factors that place children at greatest risk of undernutrition.³⁹⁸ Good infant and young child feeding practices, and micronutrient supplementation are the leading recommended nutrition-specific interventions.³⁹⁹

2003 Global Strategy for Infant and Young Child Feeding

The 2003 Global Strategy for Infant and Young Child Feeding was developed jointly by WHO and UNICEF, and remains endorsed and strongly promoted by both.

Nutrition is described as central to child development and a human right.⁴⁰⁰ Nutrition outcomes and interventions are very strongly framed in terms of the mother–child dyad, which is described as 'a biological and social unit'.⁴⁰¹ Consequently, there is a strong focus on women's nutrition, including maternal nutrition, and the broader contextual factors—including legal frameworks, cultural norms

³⁹⁴ United Nations Children's Fund, *Facts for life*, 4th edition, UNICEF, WHO, UNESCO, UNFPA, UNDP, UNAIDS, WFP, and World Bank, 2010.

³⁹⁵ United Nations Children's Fund

³⁹⁶ United Nations Children's Fund

³⁹⁷ United Nations Children's Fund

³⁹⁸ United Nations Children's Fund

³⁹⁹ United Nations Children's Fund

⁴⁰⁰ World Health Organization and United Nations Children's Fund, *Global strategy for infant and young child feeding*, WHO, Geneva, 2003.

⁴⁰¹ World Health Organization and United Nations Children's Fund, *Global strategy for infant and young child feeding*

and health service accessibility—that support or constrain women’s infant and young child feeding practices.⁴⁰²

The fortification of staple foods or condiments, and micronutrient supplementation are listed as effective actions to support nutrition.⁴⁰³ However, the stated preferred option is to provide a nutritionally adequate diet through breastmilk and locally sourced family foods.⁴⁰⁴

2009 Rome Principles for Sustainable Food Security

The Rome Principles for Sustainable Food Security were adopted at the 2009 World Summit on Food Security, hosted by the Food and Agriculture Organization of the United Nations (FAO) and attended by delegates from more than 180 countries.

The Rome Principles position nutrition as an agriculture and food security issue, without reference to the impact of health or care on nutrition status.⁴⁰⁵ Furthermore, the focus is on hunger rather than nutrition; this entails a focus on energy rather than nutrients.⁴⁰⁶ The focus is on the causes of food insecurity, with a twin-track approach recommended to alleviate hunger in the immediate term while also acting on longer term causes.⁴⁰⁷ The three key areas for action are identified as agricultural productivity and food production systems; coordination and governance at national, regional and global levels; and country ownership of integrated food security plans.⁴⁰⁸

1,000 Days Partnership

The 1,000 Days Partnership is an ‘advocacy hub’ that brings together governments, multilateral organisations and non-government organisations.⁴⁰⁹

The 1,000 Days approach is strongly informed by the UNICEF framework of child undernutrition, with nutrition conceptualised in terms of the mother–child dyad, occurring at the intersection of food, health and care, and impacted by proximal and distal risk factors.⁴¹⁰ However, the partnership diverges from the UNICEF framework in focusing on direct, nutrition-specific interventions that target

⁴⁰² World Health Organization and United Nations Children’s Fund, *Global strategy for infant and young child feeding*

⁴⁰³ World Health Organization and United Nations Children’s Fund, *Global strategy for infant and young child feeding*

⁴⁰⁴ World Health Organization and United Nations Children’s Fund, *Global strategy for infant and young child feeding*

⁴⁰⁵ Food and Agriculture Organization of the United Nations, *Declaration of the World Summit on Food Security*, World Summit on Food Security, Rome, 16–18 November 2009, FAO, Rome, 2009.

⁴⁰⁶ Food and Agriculture Organization of the United Nations, *Declaration of the World Summit on Food Security*, World Summit on Food Security

⁴⁰⁷ Food and Agriculture Organization of the United Nations, *Declaration of the World Summit on Food Security*, World Summit on Food Security

⁴⁰⁸ Food and Agriculture Organization of the United Nations, *Declaration of the World Summit on Food Security*, World Summit on Food Security

⁴⁰⁹ 1,000 Days, *What we do*, 1,000 Days, accessed 9 May 2013, www.thousanddays.org/about/what-we-do.

⁴¹⁰ 1,000 Days, *Why 1,000 days*, 1,000 Days, accessed 9 May 2013, www.thousanddays.org/about.

proximal risk factors for child undernutrition within the 1000 days covering pregnancy and the first 2 years of life.⁴¹¹

REACH

Renewed Efforts Against Child Hunger and Undernutrition (REACH) is a joint United Nations initiative to support achievements towards Millennium Development Goal 1: to halve the proportion of underweight children under 5 years of age by 2015.⁴¹² REACH was jointly developed by WHO, UNICEF, the FAO and the WFP, with supplementary advice from the International Fund for Agricultural Development.⁴¹³ REACH thus represents an approach to child undernutrition agreed upon by the four United Nations agencies with mandates most closely related to nutrition.

REACH draws strongly on the UNICEF framework for child undernutrition—equal weight is given to food, health and care as causes of undernutrition, and nutrition-specific actions in the immediate term are considered to include action on both maternal and child health.⁴¹⁴ REACH is also linked with the 1,000 Days Partnership.⁴¹⁵ REACH approaches child undernutrition through governance and a multisectoral approach.⁴¹⁶ It is premised on the understanding that the causes of child undernutrition cross multiple sectors, and that therefore strong nutrition governance is required to effectively develop and deliver multisectoral responses.⁴¹⁷ REACH focuses on the coordination of multiple government sectors, as well as coordination between development partners.⁴¹⁸

Scaling Up Nutrition Movement

The Scaling Up Nutrition (SUN) Movement is a partnership between ‘developing countries, academic and research institutions, civil society organizations, the private sector, bilateral development agencies, United Nations specialized agencies (FAO, UNICEF, WFP, and WHO), nutrition-specific collaboration organizations of the United Nations (SCN and REACH), and the World Bank’.⁴¹⁹ The movement provides a framework to mobilise and guide action on child undernutrition.

SUN takes a twin-track approach to child undernutrition, combining a focus on proximal risk factors, to be targeted within the 1000-day window, with a focus on distal risk factors, to be targeted through

⁴¹¹ 1,000 Days, *What we do*

⁴¹² B Pearson and B Ljungqvist, REACH: an effective catalyst for scaling up priority nutrition interventions at the country level. *Food and Nutrition Bulletin* 32(2 (Suppl)):S115–S127, 2011.

⁴¹³ World Food Programme, *About REACH*, accessed 9 May 2013, www.reachpartnership.org/about-reach.

⁴¹⁴ Pearson and Ljungqvist

⁴¹⁵ Pearson and Ljungqvist

⁴¹⁶ Pearson and Ljungqvist

⁴¹⁷ REACH Secretariat, *Summary brief*, REACH, Italy.

⁴¹⁸ World Food Programme, *About REACH*; REACH Secretariat, *Summary brief*

⁴¹⁹ Center for Global Development, International Conference on Nutrition, European Commission, United Nations Standing Committee on Nutrition, USAID, United Nations Children’s Fund, World Food Programme, World Health Organization and World Bank, *Scaling up nutrition: a framework for action*, CGD, ICN, EC, UNSCN, USAID, UNICEF, WFP, WHO and World Bank, 2010.

nutrition-sensitive interventions across multiple sectors.⁴²⁰ Under the SUN framework, sectors most relevant to nutrition-sensitive interventions are agriculture, social protection and health. Education, gender, governance, water, sanitation and hygiene are considered relevant but less closely linked to nutrition outcomes.⁴²¹ SUN also extends the understanding of nutrition-sensitive approaches to include a whole-of-government ‘do no harm’ approach, to ensure that actions across all sectors do not have negative impacts on nutrition outcomes.⁴²² SUN advocates country ownership and a centralised governance structure,⁴²³ with an emphasis on coordination and the inclusion of civil society and other stakeholders in decision-making.⁴²⁴ The SUN Movement Strategy 2012–2015 emphasises governance and alignment as key modalities for national and global action on child undernutrition.⁴²⁵

Maternal, Infant and Young Child Nutrition Comprehensive Implementation Plan

The Maternal, Infant and Young Child Nutrition Comprehensive Implementation Plan was developed by WHO and adopted at the 65th World Health Assembly in 2012.⁴²⁶

The plan sets six global targets, to be achieved by 2025:⁴²⁷

- › 40 per cent reduction of stunting in children under 5 years of age
- › 50 per cent reduction of anaemia in women of reproductive age
- › 30 per cent reduction of low birthweight
- › no increase in childhood overweight
- › rate of exclusive breastfeeding in the first 6 months increased to 50 per cent
- › childhood wasting reduced to less than 5 per cent.⁴²⁸

⁴²⁰ Center for Global Development, International Conference on Nutrition, European Commission, United Nations Standing Committee on Nutrition, USAID, United Nations Children’s Fund, World Food Programme, World Health Organization and World Bank

⁴²¹ Center for Global Development, International Conference on Nutrition, European Commission, United Nations Standing Committee on Nutrition, USAID, United Nations Children’s Fund, World Food Programme, World Health Organization and World Bank

⁴²² Center for Global Development, International Conference on Nutrition, European Commission, United Nations Standing Committee on Nutrition, USAID, United Nations Children’s Fund, World Food Programme, World Health Organization and World Bank

⁴²³ Scaling Up Nutrition Road Map Task Team, *A road map for Scaling-Up Nutrition (SUN)*

⁴²⁴ Center for Global Development, International Conference on Nutrition, European Commission, United Nations Standing Committee on Nutrition, USAID, United Nations Children’s Fund, World Food Programme, World Health Organization and World Bank; Special Representative of the UN Secretary General for Food Security and Nutrition, *Progress report from countries and their partners in the Movement to Scale Up Nutrition (SUN)*, United Nations High Level Meeting on Nutrition, New York, 20 September 2011.

⁴²⁵ Scaling Up Nutrition Lead Group, *Scaling Up Nutrition (SUN) movement strategy 2012–2015*, SUN, 2012.

⁴²⁶ World Health Organization, Comprehensive implementation plan on maternal, infant and young child nutrition. In: *Sixty-fifth World Health Assembly*, Geneva, 21–26 May 2012, WHO, Geneva, 2012, 55–68.

⁴²⁷ World Health Organization

These targets focus on the interconnections between maternal and child nutrition across the life cycle, and the double burden of malnutrition.

9 Selected donors who are signatories to the SUN framework

Although this section focuses on bilateral aid agencies, as a reference for the Australian Government Department of Foreign Affairs and Trade, it should be noted that some development banks are also an important source of funding. The World Bank takes a 'systems' approach to health, population and nutrition, but also provides loans and technical assistance for nutrition-focused programs in a number of countries, including Senegal and Peru. The World Bank is a signatory to the Scaling Up Nutrition (SUN) Framework.

In June 2013, the Institute for Development Studies published a new Donor Hunger and Nutrition Commitment Index, measuring a wide range of factors to determine overall political commitment of donor countries to tackling hunger and undernutrition. These include the amount of aid given for agriculture, food security and nutrition, and policies and treaties that could impact on hunger and nutrition levels in poor countries. Out of 23 members of the Organisation for Economic Co-operation and Development (OECD), the donor countries in Table 4 ranked as follows in their level of commitment: United Kingdom (UK) (1st), Canada (2nd), Denmark (3rd), Ireland (5th), Japan (15th) and the United States (18th).

Australia ranked 12th, and the European Commission (EC) was not ranked.⁴²⁹

The UK particularly owes its high ranking—just above that of Canada and Denmark—to its strong performance on policy, program and legal indicators. It does well for supporting the SUN Movement, and for its biodiversity protecting agreements and relatively low levels of protection of domestic agricultural markets. In terms of spending, the UK has a strong record of delivering on its commitments for nutrition; its official development assistance support for nutrition (although not the highest) has been stable and enduring over the past decade.

However, the UK scores poorly compared with other countries on several spending indicators: its levels of aid funding for agricultural development, food security and climate change are comparatively low.

Canada does well on policies, programs and legal indicators. It supports the SUN Movement, does well in terms of low protection of agricultural markets, sets relatively low biofuel blending mandates and is among the top performers in delivering on its greenhouse gas emission reduction pledges. Its performance on spending indicators is variable. Canada leads in terms of its enduringly stable financial support for agriculture and food security over the past decade. However, Canada also shows weak spending performance on social protection, and climate change adaptation and mitigation.

⁴²⁹ Institute of Development Studies, *Hunger and nutrition commitment index – donor index*, IDS, Brighton, 2013.

Denmark scores well for spending indicators. It gives a solid performance in terms of supporting nutrition, and this support is stable and enduring. It also invests well in climate change adaptation and mitigation. Denmark does poorly in terms of delivering on its greenhouse gas emission reduction pledges, yet is leading on the development of domestic climate change adaptation strategies and plans.

Ireland gains especially strong scores on biodiversity and endorsement of SUN, and is among the top donors investing in social protection. Ireland also shows enduring and stable financial support for agriculture and food security.

Table 4 Summary: major focus of nutrition-related work by selected donors

Donor (HANCI ranking)	Thematic location of nutrition activities	Type of nutrition programming	Strategic approach	Major research focus area(s)
Canada (#2)	Food security	Twin-track	Avert child deaths	Micronutrients Agricultural productivity Infant and young child feeding
Denmark (#3)	Social development	Nutrition-sensitive	Address distal risk factors	Nutrition-sensitive programming
European Commission (na)	Food security Social protection Humanitarian	Twin-track	Develop resilience	Agricultural productivity Food production systems
Ireland (#5)	Hunger	Twin-track	High-level advocacy on hunger Align with the SUN framework	Agricultural productivity Food production systems Nutrition governance
Japan (#15)	Rural development Maternal, neonatal and child health	Nutrition focus not clearly articulated	Nutrition approach not clearly articulated	Agricultural productivity
United Kingdom (#1)	Nutrition Mainstreamed	Twin-track	Align with the SUN framework	Nutrition-sensitive programming Agricultural productivity
United States (#18)	Health Food security	Twin-track	Support rural development	Agricultural productivity Food production systems

HANCI = Hunger and Nutrition Commitment Index; na = not applicable; SUN = Scaling Up Nutrition

Canada

The Canadian International Development Agency (CIDA) addresses nutrition through its food security focus area.⁴³⁰ Large food security initiatives, such as the development of food supply systems to ensure the availability and stability of food,⁴³¹ could be considered to be nutrition interventions. However, there are few nutrition outcomes or indicators integrated into food security initiatives; rather, nutrition is addressed through action on its immediate causes, with an almost exclusive focus on micronutrient supplementation (including micronutrients delivered through dietary diversification, fortification and school feeding) and deworming.⁴³² It is important to note that undernutrition is

⁴³⁰ S Mutuma, E Fremont and A Adebayo, *Aid for nutrition: can investments to scale up nutrition actions be accurately tracked?*, ACF International, 2012.

⁴³¹ Canadian International Development Agency, *Increasing food security: CIDA's food security strategy*, CIDA, Ottawa, n.d.

⁴³² Mutuma, Fremont and Adebayo; Canadian International Development Agency, *Increasing food security: CIDA's food security strategy*

positioned as an outcome of food insecurity, with limited focus on the longer-term causes driving undernutrition. Consequently, actions to address undernutrition are weighted towards preventing deaths from undernutrition, rather than directly tackling its driving causes.⁴³³ CIDA has identified a need for improved understanding of how nutrition fits within the food security framework.⁴³⁴

Nutrition programming is developed separately from programs addressing infant and young child feeding, which are grouped within child survival under the children and youth focus area.⁴³⁵

CIDA supports research related to micronutrients, agricultural productivity and broader food security issues. Much of its research funding is channelled through the global research bodies CGIAR (formerly the Consultative Group on International Agricultural Research) and HarvestPlus.⁴³⁶ Key research areas are basic research in the biofortification of staple foods and the development of drought-resistant crop varieties.⁴³⁷

Denmark

Denmark's international development agency, Danida, does not identify nutrition as a major organisational priority. Rather, the agency focuses on broader development goals, which align closely with the basic causes of child undernutrition: governance, macroeconomic development, social development and social protection.⁴³⁸ Within this framework, nutrition is explicitly addressed through agricultural programs, which sit under social development.⁴³⁹ Programs are nutrition-sensitive, rather than nutrition-specific, and include developing food production systems and strengthening property rights to agricultural inputs such as land.⁴⁴⁰ Danida also addresses nutrition in humanitarian and emergency settings through food aid.⁴⁴¹

Danida has supported research to identify effective interventions targeting the distal risk factors for child undernutrition; this aligns with its organisational focus on broad development goals.⁴⁴² Danida has also supported research addressing specific nutrition issues as identified by country partners, such as techniques to increase dietary diversity within a specific local context.⁴⁴³

⁴³³ Foreign Affairs, Trade and Development Canada, *Nutrition*, Foreign Affairs, Trade and Development Canada, accessed 7 May 2013, www.acdi-cida.gc.ca/acdi-cida/ACDI-CIDA.nsf/eng/FRA-4422402-563.

⁴³⁴ Canadian International Development Agency, *Increasing food security: CIDA's food security strategy*

⁴³⁵ Foreign Affairs, Trade and Development Canada, *Aid effectiveness agenda*, Foreign Affairs, Trade and Development Canada, accessed 7 May 2013, www.acdi-cida.gc.ca/acdi-cida/ACDI-CIDA.nsf/eng/FRA-825105226-KFT.

⁴³⁶ Foreign Affairs, Trade and Development Canada, *Nutrition*

⁴³⁷ Foreign Affairs, Trade and Development Canada, *Nutrition*; Di Ciommo

⁴³⁸ Di Ciommo

⁴³⁹ Di Ciommo

⁴⁴⁰ Di Ciommo

⁴⁴¹ Di Ciommo

⁴⁴² Pridmore and Carr-Hill, *Addressing the underlying and basic causes of child undernutrition in developing countries: what works and why?*

⁴⁴³ Ministry of Foreign Affairs of Denmark, *Lessons learned from Danida supported research for health in development*, Ministry of Foreign Affairs of Denmark (Danida), Copenhagen, 2010.

European Commission

The EC addresses nutrition through two separate organisations: the European Community Humanitarian Office (ECHO), which is responsible for humanitarian and emergency settings, and the Directorate-General for Development Cooperation (DEVCO), which is responsible for development activities.⁴⁴⁴ Currently, nutrition programming across these two organisations is unified through the concept of resilience to shocks that affect food security—humanitarian programming strengthens recovery from shocks, and development programming strengthens resistance to shocks.⁴⁴⁵ Under this strategy, nutrition is closely linked with the frameworks of food security and social protection, as well as the humanitarian approach of mitigating the impacts of undernutrition to avert deaths.

ECHO places nutrition under the focus area of humanitarian aid and civil protection.⁴⁴⁶ The focus of ECHO actions is to reduce deaths from undernutrition, which is generally addressed through increasing food intake in the immediate term, often through ready-to-use therapeutic foods.⁴⁴⁷

In the past, DEVCO has addressed nutrition through action across multiple program areas, including maternal and child health; poverty reduction; and water, sanitation and hygiene.⁴⁴⁸ Under the current focus on resilience, most nutrition actions are framed through food security.⁴⁴⁹ Actions address all four dimensions of food security: availability, accessibility, utilisation and stability.⁴⁵⁰ Within fragile or vulnerable countries, actions to promote nutrition through food security are also integrated with social protection mechanisms, including social transfers and infrastructure development.⁴⁵¹ Additionally, DEVCO works to promote food security through strengthening the governance of global, regional and national food supply systems.⁴⁵² Furthermore, DEVCO recognises the multisectoral nature of nutrition, and has scope to develop nutrition-sensitive interventions across multiple sectors, including rural development, public health and education.⁴⁵³

EC support for research on nutrition is focused on agricultural research and technologies to support agricultural productivity and rural development, as a way to improve food security through

⁴⁴⁴ Dangour, Diaz, Connolly, Miller and Lam

⁴⁴⁵ European Commission, *Enhancing maternal and child nutrition in external assistance: an EU policy framework*, Communication from the Commission to the European Parliament and the Council, EC, Brussels, 2013; European Commission, *The EU approach to resilience: learning from food security crises*, EC, Brussels, 2012.

⁴⁴⁶ European Commission, *Nutrition*, EC, accessed 15 April 2013, http://ec.europa.eu/echo/policies/nutrition_en.htm.

⁴⁴⁷ European Commission, *Addressing undernutrition in emergencies*, EC, Brussels, 2013; Mutuma, Fremont and Adebayo

⁴⁴⁸ Di Ciommo; European Commission, *Nutrition*, ECHO fact sheet, Humanitarian Aid and Civil Protection, EC Brussels, 2013.

⁴⁴⁹ European Commission, *Thematic strategy paper (update) and multiannual indicative programme 2011–2013*, Food Security Thematic Programme, EC, Brussels, 2010; Mutuma, Fremont and Adebayo

⁴⁵⁰ European Commission, *Thematic strategy paper (update) and multiannual indicative programme 2011–2013*

⁴⁵¹ European Commission, *Thematic strategy paper (update) and multiannual indicative programme 2011–2013*

⁴⁵² European Commission, *Thematic strategy paper (update) and multiannual indicative programme 2011–2013*

⁴⁵³ Di Ciommo

strengthening the agricultural sector.⁴⁵⁴ This includes both basic research (e.g. research into the impacts of horticulture and biodiversity interventions on the nutritional adequacy of food) and implementation research into food production and food supply systems (e.g. research into how value chains and market access can support rural development).⁴⁵⁵ Most EC nutrition research funding is channelled through CGIAR.⁴⁵⁶

Ireland

'Hunger' is a cornerstone of Ireland's foreign and aid policies, and policies to support action on hunger have been adopted in both Irish Aid and the Department of Foreign Affairs.⁴⁵⁷ The government has established an expert Hunger Task Force and appointed a Special Envoy on Hunger. Irish Aid has a centralised Hunger Unit⁴⁵⁸ and has a commitment to spend 20 per cent of official development assistance on hunger by 2013.⁴⁵⁹ There are conceptual differences between nutrition and hunger—hunger focuses on satiation from food, whereas nutrition focuses on energy and nutrients; thus, not all hungry people have undernutrition and vice versa.⁴⁶⁰ Irish Aid's hunger and food security agenda has three focus areas: smallholder agriculture, maternal and infant undernutrition, and governance and leadership.⁴⁶¹ Nutrition relates to all three areas, but is directly addressed through maternal and infant undernutrition. This separates nutrition-specific programming from agriculture and governance strategies, although these are also designed with reference to hunger.

Irish Aid's nutrition-specific interventions are designed with reference to the 1000-day window and with a focus on the mother–child dyad.⁴⁶² Nutrition objectives are also included in many nutrition-relevant programs, particularly agriculture and livelihood, making these programs nutrition-sensitive.⁴⁶³ A major nutrition-sensitive approach is Irish Aid's strong focus on women smallholder farmers within its agriculture programs.⁴⁶⁴ Irish Aid also works with governments to encourage the prioritisation of nutrition in national agendas.⁴⁶⁵

⁴⁵⁴ European Commission, *Thematic strategy paper (update) and multiannual indicative programme 2011–2013*

⁴⁵⁵ European Commission, *Thematic strategy paper (update) and multiannual indicative programme 2011–2013*

⁴⁵⁶ European Commission, *Thematic strategy paper (update) and multiannual indicative programme 2011–2013*

⁴⁵⁷ K Farrell, *Hunger Envoy report: report to the Government of Ireland*, 2010.

⁴⁵⁸ Farrell

⁴⁵⁹ Farrell

⁴⁶⁰ D te Lintelo, L Haddad, R Lakshman and K Gatelloer, *The Hunger and Nutrition Commitment Index (HNCI 2012): measuring the political commitment to reduce hunger and undernutrition in developing countries*, Institute of Development Studies, Brighton, 2013.

⁴⁶¹ Farrell

⁴⁶² Irish Aid, *Nutrition*, accessed 15 April 2013, www.irishaid.gov.ie/what-we-do/our-priority-areas/hunger/nutrition.

⁴⁶³ Farrell; Irish Aid, *Agriculture*, accessed 15 April 2013, www.irishaid.gov.ie/what-we-do/our-priority-areas/hunger/agriculture.

⁴⁶⁴ Irish Aid

⁴⁶⁵ Di Ciommo; Farrell

Irish Aid supports research focused on agricultural innovation and local agricultural productivity across a number of countries.⁴⁶⁶ It provides core funding to CGIAR and funds CGIAR programs in selected countries.⁴⁶⁷ Research areas include the development of drought-resistant and biofortified crops, improved crop yields and more sustainable farming practices.⁴⁶⁸ Other research addresses the theme of climate change and hunger reduction through adaptation of food production systems.⁴⁶⁹ Across all research, there is a focus on dissemination of results to producers, particularly smallholder farmers.⁴⁷⁰

Japan

The Japan International Cooperation Agency (JICA) does not appear to prioritise nutrition as a program area.⁴⁷¹ JICA anticipates positive nutrition outcomes from two of its program areas: rural development; and maternal, neonatal and child health.⁴⁷² However, neither of these program areas has a strong focus on nutrition. Rather, rural development programs are framed in terms of their impact on food security and economic growth,⁴⁷³ while health programs focus on health system strengthening and country-led approaches.⁴⁷⁴ JICA does not have a stated nutrition strategy or agenda within either of these program areas.

JICA supports basic research to improve rice yields through high-yield varieties, as well as improved cultivation techniques and mechanisation.⁴⁷⁵ JICA also supports research into aquaculture technologies, with a focus on dissemination of results to small-scale producers; given the importance of fish as a protein source in low-income countries, this research is considered by JICA to address nutrition issues.⁴⁷⁶

⁴⁶⁶ Farrell

⁴⁶⁷ Farrell

⁴⁶⁸ Irish Aid, *Agriculture*

⁴⁶⁹ Institute of Development Studies, *Programme partnership between Irish Aid and IDS on hunger reduction and climate change adaptation*, IDS, accessed 13 May 2013, www.ids.ac.uk/project/programme-partnership-between-irish-aid-and-ids-on-hunger-reduction-and-climate-change-adaptation.

⁴⁷⁰ Irish Aid, *Agriculture*

⁴⁷¹ Japan International Cooperation Agency, *Japan International Cooperation Agency Annual report 2012: inclusive and dynamic development*, JICA, Tokyo, 2012.

⁴⁷² Di Ciommo; Japan International Cooperation Agency, *Japan International Cooperation Agency Annual report 2012: inclusive and dynamic development*

⁴⁷³ Japan International Cooperation Agency, *Agricultural and rural development*, JICA, accessed 15 April 2013, www.jica.go.jp/english/our_work/thematic_issues/agricultural/activity.html.

⁴⁷⁴ Di Ciommo

⁴⁷⁵ Japan International Cooperation Agency, *Agricultural and rural development: case studies*, JICA, accessed 15 April 2013, www.jica.go.jp/english/our_work/thematic_issues/agricultural/study.html.

⁴⁷⁶ Japan International Cooperation Agency, *Fisheries: case studies*, JICA, accessed 15 April 2013, www.jica.go.jp/english/our_work/thematic_issues/fisheries/study.html.

United Kingdom

The Department for International Development (DFID) has a strong focus on child undernutrition and a detailed nutrition strategy.⁴⁷⁷ DFID adopts a twin-track approach to child undernutrition, informed by a life cycle approach to women's and maternal health. The department draws strongly on the SUN framework, which is identified as a policy consensus at the global level.⁴⁷⁸

Adolescent girls, pregnant women and children under 5 years of age are targeted with nutrition-specific interventions that are cost-effective and have a well-developed evidence base, including interventions that are recommended for use within the 1000-day window covering pregnancy and the first 2 years of life.⁴⁷⁹ Many of these nutrition-specific interventions are channelled through health and humanitarian program areas.⁴⁸⁰ This direct approach is complemented by indirect, nutrition-sensitive actions in multiple sectors, including agriculture, environment and social protection, as well as extreme poverty.⁴⁸¹

From 2011, DFID has reoriented its approach to focus more strongly on the role of the private sector in expanding the coverage of nutrition-specific interventions such as the fortification of staple foods, as well as nutrition-sensitive interventions such as developing food supply systems.⁴⁸² However, DFID has identified a need to clarify its position on the role of the private sector.⁴⁸³ DFID identifies civil society as key to generating demand for nutrition and holding country governments to account.⁴⁸⁴ Following the SUN framework, DFID also identifies political leadership and collaboration as key to action on child undernutrition.⁴⁸⁵

Much of DFID's research is designed to develop the evidence base for nutrition-sensitive programming.⁴⁸⁶ DFID has funded systematic reviews of the impact of nutrition-sensitive programs, large trials to assess the effectiveness of particular interventions, and evaluations of its own nutrition-sensitive programs.⁴⁸⁷ DFID also supports impact evaluations conducted by the World Bank, to generate evidence on the nutrition impacts of nutrition-sensitive World Bank programs in sectors

⁴⁷⁷ Department for International Development, *Scaling up nutrition: the UK's position paper on undernutrition*, DFID, London, 2011.

⁴⁷⁸ Department for International Development, *Scaling up nutrition: the UK's position paper on undernutrition*

⁴⁷⁹ Mutuma, Fremont and Adebayo

⁴⁸⁰ Department for International Development, *Scaling up nutrition: the UK's position paper on undernutrition*

⁴⁸¹ Department for International Development, *Scaling up nutrition: the UK's position paper on undernutrition*

⁴⁸² Department for International Development, *Scaling up nutrition: the UK's position paper on undernutrition*

⁴⁸³ Department for International Development, *Scaling up nutrition: the UK's position paper on undernutrition*

⁴⁸⁴ Department for International Development, *Scaling up nutrition: the UK's position paper on undernutrition*

⁴⁸⁵ Department for International Development, *Scaling up nutrition: the UK's position paper on undernutrition*

⁴⁸⁶ Department for International Development, *Scaling up nutrition: the UK's position paper on undernutrition*

⁴⁸⁷ Department for International Development, *Scaling up nutrition: the UK's position paper on undernutrition*

including agriculture, social protection, child development and environmental health.⁴⁸⁸ In addition, DFID supports basic research to improve agricultural productivity, focused on biofortification and drought-resistant crops, through HarvestPlus and CGIAR.⁴⁸⁹ Finally, DFID has funded two research program consortia over 5 years (2011–16) to investigate particularly challenging areas of nutrition research: maintaining the effectiveness of proven interventions in diverse contexts, and the linkages between agricultural development and nutrition in south Asia.⁴⁹⁰

United States

The United States Agency for International Development (USAID) has a technical resource facility for nutrition: the Food and Nutrition Technical Assistance (FANTA) project.⁴⁹¹ FANTA provides technical support to USAID, country governments and non-government organisations in the areas of maternal and child health and nutrition, in both emergency and development contexts; food security and livelihood strengthening; agriculture and nutrition linkages; and emergency assistance in nutrition crises.⁴⁹² Predominantly, however, USAID addresses child undernutrition through two large-scale programs: the Global Health Initiative and Feed the Future.⁴⁹³

Where the Global Health Initiative operates in food-insecure countries, specific health areas, including HIV/AIDS, malaria, and maternal and child health, are adjusted to become nutrition-sensitive.⁴⁹⁴ However, nutrition is a minor priority within the Global Health Initiative, receiving only 1 per cent of its budget over 2010–13.⁴⁹⁵

The majority of USAID nutrition programming is delivered through Feed the Future, a hunger and food security program with a global focus, which delivers integrated agriculture, nutrition and health programs with nutrition indicators and outcomes as high-level reporting indicators.⁴⁹⁶ Nutrition is thus framed in terms of food security, rural development and agricultural productivity. Areas of focus for programming include agricultural technologies to increase productivity and food supply systems, with an emphasis on the role of the private sector in developing value chains and market access.⁴⁹⁷ These approaches support agriculture-led economic growth, which is a key strategic goal of USAID's approach to nutrition through improved food security and rural livelihoods.⁴⁹⁸ To supplement this indirect approach, USAID also supports direct nutrition-specific interventions with a well-developed evidence base that target the 1000-day window covering pregnancy and the first 2 years of life; these

⁴⁸⁸ Department for International Development, *Scaling up nutrition: the UK's position paper on undernutrition*

⁴⁸⁹ Di Ciommo

⁴⁹⁰ Department for International Development, *Scaling up nutrition: the UK's position paper on undernutrition*

⁴⁹¹ *About the Food and Nutrition Technical Assistance III Project (FANTA)*, accessed 15 May 2013, www.fantaproject.org/about.

⁴⁹² *About the Food and Nutrition Technical Assistance III Project (FANTA)*

⁴⁹³ USAID, *US investments in global nutrition: fact sheet*, Feed the Future/Global Health Initiative, 2011.

⁴⁹⁴ US Global Health Initiative, *Target: nutrition*, www.ghi.gov/results/docs/NutritionTarget.pdf.

⁴⁹⁵ Di Ciommo

⁴⁹⁶ USAID, *US investments in global nutrition: fact sheet*

⁴⁹⁷ USAID, *Feed the Future guide*, USAID and Feed the Future, 2010.

⁴⁹⁸ USAID

include infant and young child feeding, fortification of staple foods, and targeted micronutrient supplementation.⁴⁹⁹

USAID supports research focused on increasing agricultural productivity and agricultural sector growth, with an emphasis on the role of the private sector. This includes basic research on the development of new crop varieties, and research into food production systems, including post-harvest value chains, increasing market access, and reducing risk and vulnerability.⁵⁰⁰ Much of this research funding is channelled through CGIAR.⁵⁰¹

⁴⁹⁹ USAID

⁵⁰⁰ USAID

⁵⁰¹ USAID

10 Selected think-tanks

Table 5 Summary: major focus of recent research across selected think-tanks

	Nutrition policy and governance	Nutrition and agriculture	Nutrition, household poverty and nutrition security	Nutrition in emergency contexts	Prevention through mothers and/or children	Treatment of child undernutrition
Institute of Development Studies	X					
International Development Research Centre		X			X	
International Food Policy Research Institute	X	X	X		X	X
Overseas Development Institute		X	X	X	X	X
Action Contre la Faim	X	X	X	X	X	X

Institute of Development Studies

Located at the University of Sussex in the United Kingdom (UK), the Institute of Development Studies (IDS) is a not-for-profit organisation that focuses on international development research, teaching and communication. Nutrition is a key research theme for the IDS, with research activity focused on how to build political commitment to addressing undernutrition, mobilising financial and human resources to address undernutrition, and strategies for promoting research uptake. The IDS is a signatory to the Scaling up Nutrition (SUN) Movement.

Much of the IDS's research focuses strongly on nutrition governance. Recent publications have argued that effective interventions to address undernutrition are relatively well known, and that the real need is to develop effective and accountable systems through which governments can deliver these interventions in a cost-effective and sustainable way.⁵⁰² Four key components of nutrition governance are identified: intersectoral cooperation, vertical coordination between different levels of government, sustainable funding, and monitoring and advocacy. This leads to the following four key policy recommendations for ensuring effective nutrition governance and reducing child undernutrition.⁵⁰³

- › Ensure strong executive leadership by country governments to drive intersectoral collaboration.

⁵⁰² Haddad, Acosta and Fanzo

⁵⁰³ Haddad, Acosta and Fanzo

- › Establish effective bodies with appropriate political support and funding sources to coordinate action on undernutrition across government ministries.
- › Secure predictable, sustainable and transparent funding for nutrition programs.
- › Invest in monitoring and advocacy, including developing a single narrative around the burden of undernutrition and the targets, to gain political commitment from all stakeholders.

The IDS produces the Hunger and Nutrition Commitment Index (HANCI), which ranks low- and middle-income country governments and donor countries on their political commitment to tackling hunger and undernutrition. The index is intended as a tool for advocacy, and to promote transparency and accountability (see Section 12).

The IDS has strongly advocated for giving nutrition indicators a greater role in a post-2015 development framework, and for aligning a post-Millennium Development Goal (MDG) framework with the work of the SUN Movement.⁵⁰⁴ The IDS argues strongly that nutrition and undernutrition can be viewed in partnership with food security, but that nutrition should not be a component of food security targets, because ‘undernutrition is linked to but different from hunger, and they are both of equal importance’.⁵⁰⁵

International Development Research Centre

The International Development Research Centre (IDRC) is a Canadian Crown Corporation created by the Parliament of Canada. The IDRC supports research in developing countries to promote growth and development, with a focus on assisting these countries to use science and technology to find solutions to local problems. It supports practical research to combat hunger and malnutrition in developing countries, including production of more robust and nutritious crops, increasing the sustainability and productivity of agriculture, and using science and technology to increase consumption of nutritious foods.⁵⁰⁶

International Food Policy Research Institute

The International Food Policy Research Institute (IFPRI), a think-tank in Washington DC, focuses on food policy research, capacity strengthening and policy communication. IFPRI research covers a broad spectrum, from agricultural research, research to reduce household poverty and build food and nutrition security, research into the effectiveness of therapeutic interventions to treat child undernutrition, and policy research. Other topics include the effect of biofortification of crops on childhood nutrition and supplements for preventing undernutrition. The IFPRI is a signatory to the SUN Movement.

Recent IFPRI research has highlighted the lack of global focus on scaling up effective agriculture, development and nutrition interventions. This research highlights the need to involve diverse actors in

⁵⁰⁴ L Haddad and J Corbett, *Embedding nutrition in a post-2015 development framework*, Policy Briefing 33, Institute of Development Studies, Brighton, 2013.

⁵⁰⁵ Haddad and Corbett

⁵⁰⁶ International Development Research Centre, *Food security and nutrition*, Lasting impacts: how IDRC-funded research has improved lives in the developing world, IDRC, Canada, 2010.

scale-up efforts, including different levels of government, civil society, donors, the private sector, and farmers and rural communities.⁵⁰⁷

The IFPRI stresses the need to work multisectorally across agriculture and health to address undernutrition. The MDGs have been criticised for failing to provide a policy framework, strategy and implementation plan to guide multisectoral action, and failing to sufficiently spotlight inequity in progress.⁵⁰⁸ Previous IFPRI work has attempted to outline characteristics of successful multisectoral undernutrition programs, including efforts to build a shared understanding of the local nutrition situation; strong leadership on nutrition policy; and the availability of organisations with strong technical, administrative and financial capacity that value collaboration and provide incentives for action.⁵⁰⁹

After the 2008–09 global food price crisis, the IFPRI conducted research on global food production and supply systems, and developed a set of recommendations to adjust these global systems to avert and mitigate future food price shocks.⁵¹⁰ These recommendations cover action in three areas: food production, food markets and trade, and aspects of the foreign aid system relating to food policies. Specific recommendations include changes to biofuel policies, the elimination of bans and restrictions for agricultural exports, and large and well-distributed grain reserves.

With Concern Worldwide, Welthungerhilfe (a German non-government organisation) and Green Scenery, the IFPRI releases the annual Global Hunger Index, which measures undernourishment, child underweight and child mortality.⁵¹¹

The IFPRI also leads the Transform Nutrition Research Programme Consortium, which aims to assist diverse stakeholders in the most affected countries to use high-quality research in addressing undernutrition.⁵¹² Other consortium partners include the IDS, the International Centre for Diarrhoeal Disease Research Bangladesh, the Public Health Foundation of India, Save the Children UK, the University of Nairobi and the UK Department for International Development (DFID). Transform Nutrition works to strengthen the evidence base and its use in addressing undernutrition, with a focus on scaling up direct nutrition interventions, leveraging indirect interventions and creating an enabling environment. The consortium also engages in capacity development and efforts to improve research uptake.

⁵⁰⁷ J Linn, *Scaling up in agriculture, rural development, and nutrition*, 2020 Focus 19, International Food Policy Research Institute, Washington, DC, 2012.

⁵⁰⁸ J von Braun, MT Ruel and S Gillespie, *Bridging the gap between the agriculture and health sectors*, Leveraging agriculture for improving nutrition and health: conference brief 14, International Food Policy Research Institute, Washington, DC, 2011.

⁵⁰⁹ J Garrett and M Natalicchio, *Working multisectorally in nutrition: principles, practices, and case studies*, International Food Policy Research Institute, Washington, DC, 2011.

⁵¹⁰ D Headey and S Fan, *Reflections on the global food crisis: How did it happen? How has it hurt? And how can we prevent the next one?*, research monograph 165, International Food Policy Research Institute, Washington, DC, 2010.

⁵¹¹ K von Grebmer, C Ringler, M Rosegrant, T Olofinbiyi, D Wiesmann, H Fritschel, O Badiane, M Torero, Y Yohannes, J Thompson, C von Oppeln and R Rahall, *2012 Global Hunger Index: the challenge of hunger: Ensuring sustainable food security under land, water, and energy stresses*, IFPRI, Concern Worldwide, Welthungerhilfe and Green Scenery, Washington, DC, 2012.

⁵¹² Transform Nutrition Consortium Partners, *Transform nutrition*, accessed 5 May 2013, www.transformnutrition.org.

Overseas Development Institute

The Overseas Development Institute (ODI) is an independent non-government think-tank, based in London, whose research focuses on international development and humanitarian issues. The ODI's nutrition-related work predominantly focuses on agriculture, social protection, and nutrition responses in emergency and transitional contexts. The ODI is not currently a SUN Movement partner.

In a report commissioned by Save the Children and the United Nations Children's Fund (UNICEF), the ODI emphasises that economic growth is not enough to address child undernutrition. It highlights the role of focused action on health and nutrition, improvements in gender equity, political will, and well-planned and resourced programs for achievements in child nutrition.⁵¹³ The report promotes complementary action on reducing poverty; improving access to nutritious food, and water, sanitation and hygiene; increasing equitable access to health services; and reducing inequalities by targeting health, nutrition and food security interventions.

In an analysis for the UK Government of current and future challenges and opportunities in addressing food and nutrition insecurity, the ODI notes that the interventions to address undernutrition across a range of sectors are relatively well known, cost-effective and simple to implement.⁵¹⁴ The real challenges are building awareness and political will at the community and national levels, and building an understanding that child undernutrition and food crises are avoidable. The authors argue that agricultural innovations and greater availability of food and nutrition data by civil society are key opportunities for addressing food insecurity and undernutrition in the next two decades. The report further highlights the importance of an early-intervention approach, ensuring that women, pregnant mothers and infants in the first 1000 days are well nourished.

The ODI has also undertaken work with the Hunger Alliance on the contribution of sustainable smallholding agriculture to improving food security and nutrition. This research finds that smallholders are disproportionately vulnerable to food insecurity and malnutrition, but that smallholder agriculture can contribute to improvements in food security and nutrition outcomes while being environmentally sustainable. The impact of smallholder agriculture on food security and nutrition is increased by focusing on empowerment of women, home gardens and small-scale livestock that increase the home consumption of diverse foods, coupling agricultural programs with education and communication, health services, water and sanitation.

Recent research by the ODI's Humanitarian Policy Group highlights the relative dearth of evidence on the effectiveness of nutrition interventions, including cash transfers,⁵¹⁵ in emergency settings. However, the review finds that, under the right circumstances, cash transfers can increase the volume and quality of food consumption, and that vouchers are more likely than cash to be effective in addressing micronutrient deficiencies.

⁵¹³ Overseas Development Institute, Save the Children and UNICEF, *Progress in child well-being: building on what works*, Save the Children Fund, London, 2012.

⁵¹⁴ S Wiggins and R Slater, *Food security and nutrition: current and likely future issues*, Foresight Project on Global Food and Farming Futures, Government Office for Science, London, 2012.

⁵¹⁵ S Bailey and K Hedlund, *The impact of cash transfers on nutrition in emergency and transitional contexts: a review of evidence*, Humanitarian Policy Group, Overseas Development Institute, London, 2012.

Action Contre la Faim (Action Against Hunger)

Action Contre la Faim (ACF) is an international NGO with a mission to save lives through the prevention, detection and treatment of malnutrition, particularly during and following disasters and conflicts. While technically not a think-tank, ACF undertakes significant research to improve the effectiveness of nutrition interventions. ACF is a signatory to the SUN Movement.

ACF research into policies and practices that support progress in addressing child undernutrition highlight a range of factors conducive to success, including strong political leadership, civil society organisations ensuring accountability, multisectoral and multiphase approaches, coordination between institutional stakeholders, and the need for continuous, sustainable funding.⁵¹⁶

ACF has also worked with the Institute of Development Studies and Save the Children on research into financing for nutrition. This research stressed the need for proper costing of nutrition programs at country level, and called on donors to provide long-term, sustainable financing for comprehensive nutrition programs, to improve monitoring and evaluation of nutrition financing, and to improve accountability for nutrition financing.⁵¹⁷ ACF has further called on donors to address inadequate funding for undernutrition programs, and highlighted the general lack of funding for comprehensive direct nutrition programs, poor targeting of nutrition aid to countries with the highest need, and lack of transparency in nutrition financing due to poor reporting.⁵¹⁸ The donors that form the Organisation for Economic Co-operation and Development's (OECD's) Development Assistance Committee have also been criticised for allowing poor coding of nutrition spending.⁵¹⁹ The ASF research further highlights a gap in research into the effectiveness of indirect interventions that tackle the distal risk factors for undernutrition.⁵²⁰

Feinstein International Centre

The Feinstein International Centre at Tufts University in the United States aims to develop and promote operational and policy responses to protect and strengthen the lives and livelihoods of people in crisis-affected and marginalised communities. Nutrition and food security are key areas of research. Current and recent research areas include the effectiveness of food supplementation programs for people living with HIV, household food access and availability, and nutrition of children.⁵²¹

In 2011, a paper by Feinstein highlighted the complex structural factors that influence nutrition, framing individual and population nutrition status as the result of a complex social and political system.⁵²² The authors argue that addressing nutrition must move beyond single interventions and take a systems approach that considers the wide variety of constraints and drivers of nutrition. A more robust system of responding to food crises is needed, in which local actors use a mix of market-

⁵¹⁶ Sanchez-Montero, Ubach and Sullivan

⁵¹⁷ S Spratt, *Aid for nutrition: using innovative financing to end undernutrition*, ACF International, London, 2012.

⁵¹⁸ Mutuma, Fremont and Adebayo

⁵¹⁹ Mutuma, Fremont and Adebayo

⁵²⁰ Spratt

⁵²¹ Tufts University, *Feinstein International Centre website*, accessed 5 May 2013, <http://sites.tufts.edu/feinstein>.

⁵²² Kennedy, Webb, Walker, Saltzman, Maxwell, Nelson and Booth

based mechanisms for food delivery and safety nets, coupled with longer-term incentives for food production and distribution. The authors further argue that research funding needs to be allocated to implementation and operational research questions about how known nutrition interventions should be delivered, and how to support the complex social and political environment in order to achieve good nutrition. Subsequent work by Feinstein in Malawi on an Integrated Food Security Programme found that integrated, multisectoral programs that seek to leverage improvements in agriculture, nutrition and health simultaneously can be very effective in addressing child undernutrition, as well as relatively cost-effective.⁵²³

Earth Institute—Millennium Villages project

The Millennium Villages project takes an integrated, community-led approach to rural development, seeking to simultaneously address the challenges of extreme poverty through agriculture, education, health, infrastructure, gender equality and business development. The project is led by Millennium Promise, a non-government organisation focused on accelerating progress towards the MDGs, and the Earth Institute at Colombia University, in collaboration with a range of multilateral, public and private organisations.⁵²⁴ Millennium Village projects in nine sub-Saharan countries have demonstrated significant improvements in household food security and diet diversity, as well as some improvements in child care and disease-control measures, culminating in very large decreases in child stunting (a 43 per cent reduction in stunting in children under 2 years of age across all sites).⁵²⁵ Findings from this project highlight the effectiveness of community-led multisectoral interventions in addressing child undernutrition.

⁵²³ Webb, *Achieving food and nutrition security: lessons learned from the Integrated Food Security Programme (IFSP)*, Mulanje, Malawi

⁵²⁴ Millenium Promise and the Earth Institute, *Millenium Villages*, accessed 5 May 2013, www.millenniumvillages.org.

⁵²⁵ R Remans, PM Pronyk, JC Fanzo, J Chen, CA Palm, B Nemser, M Muniz, A Radunsky, AH Abay, M Coulibaly, J Mensah-Homiah, M Wagah, X An, C Mwaura, E Quintana, MA Somers, PA Sanchez, SE Sachs, JW McArthur and JD Sachs, Multisector intervention to accelerate reductions in child stunting: an observational study from 9 sub-Saharan African countries. *American Journal of Clinical Nutrition* 94(6):1632–1642, 2011.

11 Non-government organisations

Contributions of non-government organisations to child undernutrition policy thinking and approaches

Numerous international non-government organisations (NGOs) are engaged in nutrition programming, policy analysis, famine early warning systems, advocacy and operational research. A comprehensive audit of NGO policy and research activities is beyond the scope of this study; however, brief examples are provided, as well as a longer summary of the work of Action Contre la Faim, an NGO exclusively devoted to nutrition.

Médecins sans Frontières has conducted extensive field studies, including randomised controlled trials, to establish the efficacy of ready-to-use therapeutic food (PlumpyNut®). MSF's open-access research site⁵²⁶ lists 41 nutrition research publications. Concern Worldwide has been a leader in nutrition for many years, often in partnership with the International Food Policy Research Institute (IFPRI). For example, the RAIN project in Zambia, a collaborative effort with IFPRI, aims to reduce the prevalence of stunting in children through integrated agriculture, health and nutrition interventions during the 1000-day window covering pregnancy and the first 2 years of life.

Save the Children has been active in nutrition research, field programs and advocacy. For example, the 2012 edition of the *State of the world's mothers* report was titled *Nutrition in the first 1000 days*. Moreover, Save the Children is a core partner in the Transform Nutrition Research Programme Consortium (see Section 10). Pioneering work by Helen Keller International (HKI) in the 1970s revealed the connection between vitamin A deficiency and child survival. HKI continues to conduct nutrition research in 17 countries, including Bangladesh, Cambodia, Indonesia and the Philippines. Oxfam has been active in advocacy research, especially around the global food price crisis. World Vision has made nutrition a top priority for its work and has published a number of valuable evidence-based nutrition guidelines. World Vision's Nutrition Centre of Expertise provides strategic leadership to this initiative.

⁵²⁶ Médecins sans Frontières, *Field research: nutrition*, accessed 16 May 2013, <http://fieldresearch.msf.org/msf/handle/10144/10945>.

12 Country governments

HANCI methodology and approach

The Hunger and Nutrition Commitment Index (HANCI) ranks low-and middle-income country governments and donor countries on their political commitment to tackling hunger and undernutrition. The index is intended as a tool for advocacy and to promote transparency and accountability.

HANCI provides separate rankings for hunger and nutrition, because of the conceptual differences between them. However, for this review, the combined hunger and nutrition commitment ranking is more relevant, since HANCI conceptualises hunger in terms of agriculture and health services.⁵²⁷

HANCI considers three areas of government action: policies and programs, legal frameworks, and public expenditures (Table 6).⁵²⁸ These three areas reflect different stages of the implementation of political commitment. Equal weight is given to each stage in calculating the score, to effectively capture the multistage nature of political commitment.⁵²⁹ HANCI scores are calculated using data provided by country governments.

⁵²⁷ te Lintelo, Haddad, Lakshman and Gatelloer, *The Hunger and Nutrition Commitment Index (HANCI 2012): measuring the political commitment to reduce hunger and undernutrition in developing countries*

⁵²⁸ te Lintelo, Haddad, Lakshman and Gatelloer

⁵²⁹ te Lintelo, Haddad, Lakshman and Gatelloer

Table 6 Indicators used to measure hunger and nutrition commitment⁵³⁰

Policies and programs	Legal frameworks	Expenditures
<ul style="list-style-type: none"> • Vitamin A coverage • Complementary feeding • Access to improved drinking water • Access to sanitation • Skilled birth attendance • Civil registration of live births • Status of safety nets • Security of access to land • Access to agricultural extension services • Nutrition in national development policies/strategies • National nutrition plan or strategy • Time-bound nutrition targets • National nutrition survey • Multisectoral and multi-stakeholder coordination mechanism 	<ul style="list-style-type: none"> • International Code of Marketing of Breastmilk Substitutes in domestic law • Constitutional right to food • Women's access to agricultural land • Constitutional right to social security • Women's economic rights 	<ul style="list-style-type: none"> • Nutrition budget • Public expenditures on agriculture • Public expenditures on health

It should be noted that some high-ranking countries continue to have poor child nutrition indicators—the ranking reflects nutrition governance that is appraised to be the basis for future improvements. While 45 countries are included in the HANCI ranking, we provide detailed information on 6 countries:

- › Guatemala because it ranks first out of 45
- › Malawi because it ranks second and is located in southern Africa, where food security is an Australian aid priority
- › the Philippines, Indonesia and Bangladesh, because they rank in the top 25 per cent of countries and are priority countries for Australian aid
- › Myanmar, because it ranks poorly and is a high priority for Australian aid.

Guatemala

In the 2012 HANCI, Guatemala was ranked first. Guatemala has one of the world's highest stunting rates, and vitamin and mineral deficiencies are a major challenge. The high ranking is based on

⁵³⁰ te Lintelo, Haddad, Lakshman and Gatelloer

significant investment in health, with funding earmarked for nutrition. Budgetary allocations are complemented by a coherent nutrition plan, with strong support for implementation, including a national nutrition strategy with time-bound nutrition targets, and a multisectoral and multi-stakeholder coordination mechanism—recognised in the region as an example of good practice.⁵³¹ The government has also recently undertaken a national nutrition survey.

Guatemala has a very high level of access to safe drinking water (92 per cent) and a high level of access to sanitation (78 per cent). Infant and young child feeding practices are politically well supported, and health services reach almost all women during pregnancy (93 per cent of pregnant women receive skilled care at least once during pregnancy). Food accessibility is well supported through social protection mechanisms; citizens enjoy a constitutional right to social security and a well-developed constitutional right to food.

Despite this evidence of political commitment, Guatemala did not score highly on all indicators. Women's access to land and economic rights relative to men were ranked as moderate, and the country has low vitamin A coverage (36 per cent) and very low public spending on agriculture (1.4 per cent).

Malawi

Malawi ranked second in the 2012 HANCI. Key factors for success included a strong, centralised focus on nutrition, with good support for implementation, including a national nutrition policy or strategy document and a very high profile of nutrition within the broader national development strategy. Malawi also has a separate nutrition budget line and a moderately high health expenditure: 14.2 per cent of government spending is on health. Malawi ranked well on action to address distal risk factors for undernutrition. Policy implementation is well supported by a multisectoral and multi-stakeholder coordination mechanism, time-bound nutrition targets in the national strategy, and the recent completion of a national nutrition survey.

HANCI authors also note a solid enabling environment for nutrition security in Malawi, including a very well established constitutional right to food and a constitutional right to social security. In 2012, Malawi performed consistently across all indicators. Weaker areas of performance included food and agriculture indicators, and women's empowerment.

The Philippines

The Philippines ranked sixth. It scored highly in relation to nutrition policy and implementation, based on the availability of a national nutrition strategy or policy with time-bound nutrition targets, and a multisectoral and multi-stakeholder coordination mechanism. The Philippines also recognises the constitutional right to social security and has well-developed safety nets. The country has also shown strong political commitment to infant and young child feeding, gaining the highest ranking for inclusion of the International Code of Marketing of Breastmilk Substitutes (ICBMS) in domestic law and government support for complementary feeding.

Maternal neonatal and child health services in the Philippines report high rates of skilled birth attendance (91 per cent), vitamin A coverage (91 per cent), and access to water (92 per cent) and sanitation (74 per cent). Further, HANCI ranked the country highly in gender equity in economic rights, in both laws and law enforcement.

⁵³¹ te Lintelo, Haddad, Lakshman and Gatelloer

In 2012, the Philippines was held back in HANCI rankings by low scores in public expenditure on agriculture (5 per cent) and health (7.6 per cent), and lack of a nutrition budget line.

Indonesia

Indonesia ranked seventh in 2012 and performed highly in many areas. Although nutrition policy and implementation are not well funded, the country ranked highly in these areas thanks to a national nutrition policy or strategy with time-bound nutrition targets, a separate nutrition budget line, and a multisectoral and multi-stakeholder coordination mechanism. The constitutional right to social security is also well recognised, and appropriate safety nets are well developed.

The majority of citizens have access to safe drinking water (82 per cent). Indonesia performs well in relation to gender equity in access to agricultural land and was one of only five countries to be recognised for achieving such high standards. Indonesia scored only moderately, however, in relation to gender equity in economic rights.

Regarding infant feeding, the Indonesian Government has achieved a high rate of skilled care during pregnancy (93 per cent of pregnant women receive skilled care at least once during pregnancy) and a high rate of inclusion of ICBMS in domestic law; the government also promotes complementary feeding.

Indonesia's 2012 HANCI ranking was undermined by a lack of centralised focus on nutrition, the low priority afforded nutrition in national development policies, underfunding of nutrition and hunger-related programs, low birth registration (53 per cent of children aged less than 5 years), and low public spending on agriculture (5 per cent) and health (7.8 per cent).

Bangladesh

Bangladesh ranked twelfth. It has demonstrated legal and policy commitment to nutrition, and direct nutrition interventions are well supported. Bangladesh has a national nutrition policy or strategy with time-bound nutrition targets, a nutrition budget line and a reasonably high profile for nutrition in national development plans, and has undertaken a national nutrition assessment (within a Demographic and Health Survey) after 2008. Bangladesh also has a multisectoral and multi-stakeholder coordination mechanism and a constitutional right to food. Direct nutrition interventions have strong political commitment, evidenced by extremely high (100 per cent) vitamin A coverage, government support for complementary feeding and good inclusion of ICBMS in domestic law.

However, some aspects of an enabling environment are less well developed; this can undermine the potential of existing commitments. Although the constitutional right to social security is recognised and the government provides moderate safety nets, these are undermined by extremely low levels of birth registration (10 per cent, the third lowest after Liberia and Ethiopia). The government spends little on agriculture (7.3 per cent) and health (7.4 per cent).

Myanmar

Myanmar ranked very low on the 2012 HANCI, at 41. Myanmar has a nutrition policy, although it is almost 20 years old, and a multisectoral and multi-stakeholder coordination mechanism, and completed a national nutrition assessment within a Multiple Indicator Cluster Survey in 2009–10. The low ranking is partly based on lack of a nutrition budget line, lack of time-bound nutrition targets, and low priority given to nutrition in national development policy and strategy. Government spending on

health is also extremely low (1 per cent, the lowest of all countries included in HANCI), and spending on agriculture is low (8.3 per cent). There is also no constitutional right to social security, extremely low security of access to land and little access to agricultural extension services.

Despite these poor rankings, Myanmar has achieved reasonably high access to improved water (83 per cent) and sanitation (76 per cent), and good access to health services and registration—80 per cent of pregnant women receive skilled care at least once during pregnancy, 94 per cent of children receive vitamin A coverage, and 72 per cent of children aged under 5 years are completely vaccinated. The government also promotes complementary feeding and is ranked highly on inclusion of ICBMS in domestic law.

It is important to note that the HANCI study found a link between political commitment and the level of government effectiveness,⁵³² in that no country with a very low government effectiveness score (10 or less, out of a maximum possible score of 100)—a group that includes Myanmar—had a moderate or high political commitment to hunger and nutrition.

⁵³² Countries' government effectiveness score was sourced from the World Bank's *World governance indicators 2011* (see reference to Lintelo, Haddad, Lakshman and Gatelloer, *The Hunger and Nutrition Commitment Index (HANCI 2012): measuring the political commitment to reduce hunger and undernutrition in developing countries*).

Part III

Child nutrition data

13 Child nutrition status in selected countries

A summary table of data on key nutrition indicators, covering child nutrition status and relevant contextual measures, for all low- and middle-income countries east of (and including) Afghanistan, as far east as the Pacific Island countries, and southern Africa, is provided in Annex 3.

These nutrition data need to be interpreted with caution for two main reasons. First, it is not clear whether the datasets excluded outliers using the World Health Organization (WHO) recommended cut-offs for biologically implausible z-scores. This is significant because such implausible z-scores tend to inflate the observed prevalence of malnutrition. Second, where trend data have been reported, it is not clear whether the baseline and followup prevalence values have been calculated using the same reference population.

This is particularly important, because the 2006 WHO reference values (based on multisite healthy breastfed infants) are different from the United States National Centre for Health Statistics reference values used earlier. The reference population used when calculating prevalence can have a substantial impact on results. Use of the older reference population may underestimate or overestimate undernutrition, depending on the age of the child.⁵³³ The 2013 report *Levels and trends in child malnutrition* (WHO, United Nations Children's Fund and World Bank) employs the most recent WHO Growth Standards and includes converted estimates for data older than 2006.⁵³⁴

A further issue in measuring child nutrition status is data availability. In settings with a high proportion of home births, low birth registration, and/or poor data collection and management systems, statistics can be based on incomplete or unrepresentative data.

⁵³³ M de Onis, A Onyango, E Borghi, C Garza and H Yang, Comparison of the World Health Organization (WHO) Child Growth Standards and the National Center for Health Statistics/WHO international growth reference: implications for child health programmes. *Public Health Nutrition* 9(7):942–947, 2006.

⁵³⁴ United Nations Children's Fund, World Health Organization and World Bank, *Joint child malnutrition estimates – levels and trends*, 2013.

14 Interpretation of child nutrition data for selected countries

Table 7 presents the prevalence cut-off values for the public health significance of child undernutrition in populations. The source is the World Health Organization Global Database on Child Growth and Malnutrition.⁵³⁵ This section presents a brief analysis of the child nutrition status of selected countries relevant to the Australian aid program and located in the Asia–Pacific region, as well as the region of southeastern Africa where rates of child undernutrition are high and food security is a priority for Australian aid.

Table 7 Classification for assessing severity of malnutrition by prevalence range among children under 5 years of age

Indicator	Severity of undernutrition by prevalence range (%)			
	<i>Low</i>	<i>Medium</i>	<i>High</i>	<i>Very high</i>
Stunting	<20	20–29	30–39	≥40
Underweight	<10	10–19	20–29	≥30
Wasting	<5	5–9	10–14	≥15

Afghanistan

- › Progress against Millennium Development Goal 1, Target C (MDG1c):⁵³⁶ the percentage of children under 5 years of age who are underweight decreased from 44.9 per cent (in 1997) to 32.9 per cent (in 2004).⁵³⁷

Based on 2004 data, there is a very high prevalence of stunting (59 per cent of children under 5 years of age) and underweight (33 per cent).⁵³⁸ The prevalence of wasting is medium, with 9 per cent wasted.⁵³⁹ No nationally representative data on low birthweight are available.⁵⁴⁰ In 2004, more

⁵³⁵ World Health Organization, *Global database on child growth and malnutrition. Description: cut-off points and summary statistics*, WHO, accessed 12 August 2013, www.who.int/nutgrowthdb/about/introduction/en/index5.html.

⁵³⁶ To halve, between 1990 and 2015, the proportion of people who suffer from hunger. This target is measured by the percentage of children under 5 years of age who are moderately or severely underweight, as well as the percentage of the population who cannot access sufficient food to meet their minimum daily energy requirements.

⁵³⁷ United Nations Statistics Division, *Millennium Development Goals indicators*, accessed 14 May 2013, <http://mdgs.un.org/unsd/mdg/Data.aspx>.

⁵³⁸ World Health Organization, *Nutrition Landscape Information System: country profile*, WHO, accessed 9 April 2013, <http://apps.who.int/nutrition/landscape/report.aspx>.

⁵³⁹ World Health Organization

than one-third (38 per cent) of children aged 6–59 months had anaemia.⁵⁴¹ There is moderate iodine deficiency at a population level, as indicated by the median urinary iodine concentration in school-age children of 49 µg/L (2004 figures)—below the optimal range of 100–199 µg/L.⁵⁴²

Afghanistan performs poorly across multiple indicators for the distal risk factors for child undernutrition. Afghanistan is ranked 36 (of 45) in the Hunger and Nutrition Commitment Index (HNCI) (2011 figures),⁵⁴³ and nutrition governance is ranked as weak (2009).⁵⁴⁴ Political stability reaches the lower limit of the measurement index, at –2.51 (2011).⁵⁴⁵ Gender inequality is very high, with a Gender Inequality Index (GII) score of 0.707 (2011).⁵⁴⁶ The country's Human Development Index (HDI) score is very low, at 0.398 (2011).⁵⁴⁷ Additionally, access to safe water and sanitation facilities, a significant nutrition-sensitive intervention, is 50 per cent and 37 per cent, respectively (2010).⁵⁴⁸

Bangladesh

- › Progress against MDG1c: the percentage of children under 5 years of age who are underweight decreased from 61.5 per cent (in 1990) to 41.3 per cent (in 2007).⁵⁴⁹

Based on 2007 data, the prevalences among children under 5 years of age of stunting (44 per cent), underweight (42 per cent) and wasting (18 per cent) are very high.⁵⁵⁰ More than one-fifth (22 per cent) of babies are born with low birthweight (2006 figures).⁵⁵¹ Almost half (47 per cent) of all children aged 6–59 months have anaemia (2001).⁵⁵²

There are notable inequalities in child nutrition status. Young children from the poorest households are almost 2.5 times as likely to be underweight as those from the richest households (risk ratio 2.41; 2011).⁵⁵³ Young girl children are 12 per cent more likely to be underweight than boys, and young children from rural areas are 38 per cent more likely to be underweight than urban children

⁵⁴⁰ World Health Organization

⁵⁴¹ World Health Organization, *Worldwide prevalence of anaemia 1993–2005: WHO global database on anaemia*, WHO, Geneva, 2008.

⁵⁴² World Health Organization, *Nutrition Landscape Information System: country profile*

⁵⁴³ te Lintelo, Haddad, Lakshman and Gatelloer

⁵⁴⁴ World Health Organization, *Nutrition Landscape Information System: country profile*

⁵⁴⁵ Food and Agriculture Organization of the United Nations, *FAO—food security indicators*, FAO, Rome, 2012 [revised 2013], www.fao.org/fileadmin/templates/ess/foodsecurity/Food_Security_Indicators.xlsx.

⁵⁴⁶ World Health Organization, *Nutrition Landscape Information System: country profile*

⁵⁴⁷ World Health Organization, *Nutrition Landscape Information System: country profile*

⁵⁴⁸ Food and Agriculture Organization of the United Nations, *FAO—food security indicators*

⁵⁴⁹ United Nations Statistics Division, *Millennium Development Goals indicators*

⁵⁵⁰ World Health Organization, *Nutrition Landscape Information System: country profile*

⁵⁵¹ World Health Organization, *Nutrition Landscape Information System: country profile*

⁵⁵² World Health Organization, *Worldwide prevalence of anaemia 1993–2005: WHO global database on anaemia*

⁵⁵³ United Nations Children's Fund, *Underweight disparities*, accessed 16 April 2013, www.childinfo.org/malnutrition_weightbackground.php.

(2011).⁵⁵⁴ Bangladesh is one of the few countries (along with Solomon Islands) where girls are more likely to be underweight than boys.

Maternal ill health and undernutrition—an intergenerational influence on child undernutrition—is a major health issue in Bangladesh. Almost one-third (30 per cent) of adult women are underweight (2007),⁵⁵⁵ and almost half (47 per cent) of pregnant women have anaemia (2001).⁵⁵⁶ Furthermore, despite strong nutrition governance (2009)⁵⁵⁷ and a relatively high HANCI rank of 12 (out of 45) (2011),⁵⁵⁸ Bangladesh receives moderately low scores in human development (HDI 0.500; 2011)⁵⁵⁹ and political stability (−1.5; 2011)⁵⁶⁰, and a moderately high score for gender inequality (GII 0.550; 2011).⁵⁶¹ Additionally, while 64 per cent of infants are exclusively breastfed under 6 months,⁵⁶² and 9 out of 10 young children are breastfed until 2 years of age (2011),⁵⁶³ almost two-thirds (64 per cent) do not initiate breastfeeding within 1 hour of birth (2006).⁵⁶⁴

Cambodia

- › Progress against MDG1c: the percentage of children under 5 years of age who are underweight decreased from 42.6 per cent (in 1996) to 29 (in 2010).⁵⁶⁵

Based on 2010–11 figures, the prevalence of stunting among children under 5 years of age is very high, at 41 per cent, while the prevalence of underweight and wasting is high, at 29 and 11 per cent, respectively.⁵⁶⁶ Some 9 per cent of babies are born with low birthweight (2008 figures).⁵⁶⁷ There is also a very high prevalence of anaemia, with 55 per cent of children aged 6–59 months found to be anaemic (2010).⁵⁶⁸

There is only a 2 per cent disparity in the prevalence of underweight between young girl and boy children (2010).⁵⁶⁹ However, young rural children are 60 per cent more likely to be underweight than

⁵⁵⁴ United Nations Children's Fund

⁵⁵⁵ World Health Organization, *Global database on body mass index*, WHO, Geneva, 2006 [2013], <http://apps.who.int/bmi/index.jsp>.

⁵⁵⁶ World Health Organization, *Worldwide prevalence of anaemia 1993–2005: WHO global database on anaemia*

⁵⁵⁷ World Health Organization, *Nutrition Landscape Information System: country profile*

⁵⁵⁸ te Lintelo, Haddad, Lakshman and Gatelloer

⁵⁵⁹ World Health Organization, *Nutrition Landscape Information System: country profile*

⁵⁶⁰ Food and Agriculture Organization of the United Nations, *FAO—food security indicators*

⁵⁶¹ World Health Organization, *Nutrition Landscape Information System: country profile*

⁵⁶² United Nations Children's Fund, *Infant and young child feeding*, UNICEF, accessed 11 April 2013, www.childinfo.org/breastfeeding_iycf.php.

⁵⁶³ United Nations Children's Fund, *Infant and young child feeding*

⁵⁶⁴ United Nations Children's Fund, *Early initiation of breastfeeding (newborns put to the breast within one hour of birth)*, UNICEF, accessed 12 April 2013, www.childinfo.org/breastfeeding_initiation.php.

⁵⁶⁵ United Nations Statistics Division, *Millennium Development Goals indicators*

⁵⁶⁶ World Health Organization, *Nutrition Landscape Information System: country profile*

⁵⁶⁷ World Health Organization, *Nutrition Landscape Information System: country profile*

⁵⁶⁸ World Health Organization, *Worldwide prevalence of anaemia 1993–2005: WHO global database on anaemia*

⁵⁶⁹ United Nations Children's Fund, *Underweight disparities*

their urban counterparts, and children from the poorest households are more than twice as likely as children from the richest households to be underweight (risk ratio 2.23; 2010).⁵⁷⁰

Several distal risk factors for child undernutrition appear to be present to a moderate degree. The country has a moderately low HDI score (0.523; 2011)⁵⁷¹ and is relatively politically unstable (−0.44; 2011).⁵⁷² Nutrition governance was rated weak in 2009,⁵⁷³ although Cambodia has since been ranked 18 of 45 countries in HANCI (2011).⁵⁷⁴ Less than two-thirds (64 per cent) of people have access to improved water sources, and less than one-third (31 per cent) have access to adequate sanitation—this is among the lowest in Asia (2010).⁵⁷⁵ Furthermore, 45 per cent of pregnant women have anaemia (2010),⁵⁷⁶ which is a risk factor for low birthweight.

Indonesia

- Progress against MDG1c: the percentage of children under 5 years of age who are underweight decreased from 29.8 per cent (in 1992) to 19.6 per cent (in 2007).⁵⁷⁷

Based on 2011 data, the prevalence of underweight is rated medium, at 19 per cent.⁵⁷⁸ However, the prevalence of stunting (39 per cent) and wasting (12 per cent) is high (2011 figures).⁵⁷⁹ Nine per cent of babies are born with low birthweight (2007).⁵⁸⁰ Iodine overconsumption is a public health issue that indicates a risk of iodine-induced hyperthyroidism, with the median urinary iodine concentration in school-age children at 229 µg/L (2003),⁵⁸¹ above the optimal range of 100–199 µg/L.⁵⁸²

Young girls are 13 per cent less likely to be underweight than boys, and young rural children are 36 per cent more likely to be underweight than their urban counterparts (2010).⁵⁸³ The largest recorded disparities exist across wealth quintiles, with children from the poorest households more than twice as likely to be underweight as children from the richest households (risk ratio 2.18; 2010).⁵⁸⁴

Indonesia has a moderately high HDI score (0.617; 2011).⁵⁸⁵ Nutrition governance is ranked medium (2011),⁵⁸⁶ with a relatively high HANCI rank of 7 (2011).⁵⁸⁷ However, Indonesia performs poorly

⁵⁷⁰ United Nations Children's Fund, *Underweight disparities*

⁵⁷¹ World Health Organization, *Nutrition Landscape Information System: country profile*

⁵⁷² Food and Agriculture Organization of the United Nations, *FAO—food security indicators*

⁵⁷³ World Health Organization, *Nutrition Landscape Information System: country profile*

⁵⁷⁴ te Lintelo, Haddad, Lakshman and Gatelloer

⁵⁷⁵ Food and Agriculture Organization of the United Nations, *FAO—food security indicators*

⁵⁷⁶ World Health Organization, *Worldwide prevalence of anaemia 1993–2005: WHO global database on anaemia*

⁵⁷⁷ United Nations Statistics Division, *Millennium Development Goals indicators*

⁵⁷⁸ World Health Organization, *Nutrition Landscape Information System: country profile*

⁵⁷⁹ World Health Organization, *Nutrition Landscape Information System: country profile*

⁵⁸⁰ World Health Organization, *Nutrition Landscape Information System: country profile*

⁵⁸¹ World Health Organization, *Nutrition Landscape Information System: country profile*

⁵⁸² World Health Organization, *Iodine status worldwide: WHO global database on iodine deficiency*, WHO, Geneva, 2004.

⁵⁸³ United Nations Children's Fund, *Underweight disparities*

⁵⁸⁴ United Nations Children's Fund, *Underweight disparities*

⁵⁸⁵ World Health Organization, *Nutrition Landscape Information System: country profile*

against key proximal risk factors for child undernutrition. Despite the reasonably high (82 per cent) access to improved water sources, almost half the population (46 per cent) does not have access to adequate sanitation facilities (2010).⁵⁸⁸ Furthermore, breastfeeding practices are poor, with breastfeeding initiation rates very low, at 29 per cent (2010),⁵⁸⁹ and less than one-third (32 per cent) of children exclusively breastfed until 6 months (2007).⁵⁹⁰

Lao People's Democratic Republic

- › Progress against MDG1c: the percentage of children under 5 years of age who are underweight decreased from 39.8 per cent (in 1993) to 31.6 per cent (in 2006).⁵⁹¹

Based on 2006 data, the prevalences of stunting and underweight in the Lao People's Democratic Republic (PDR) are very high, with almost one-third (32 per cent) of children aged under 5 years underweight and almost half (48 per cent) stunted.⁵⁹² The prevalence of wasting is rated medium, affecting 7 per cent of children under 5 years of age (2006 figures).⁵⁹³ More than 1 in 10 babies (11 per cent) are born with low birthweight.⁵⁹⁴ Based on 2000 data, micronutrient deficiencies are common, with close to half of all children aged 6–59 months anaemic (48 per cent)⁵⁹⁵ or vitamin A deficient (45 per cent).⁵⁹⁶

Young girls are 6 per cent less likely to be underweight than boys, and young rural children are 69 per cent more likely to be underweight than urban children (2006).⁵⁹⁷ Underweight disparities are particularly sharp across wealth quintiles, with children from the poorest households almost three times as likely to be underweight as their counterparts from the richest households (2006).⁵⁹⁸

Lao PDR has a moderately low score for human development (HDI 0.524; 2011) and a moderately high score for gender inequality (GII 0.513; 2011).⁵⁹⁹ Additionally, approximately one-third of the population does not have access to improved water sources (33 per cent) or adequate sanitation facilities (37 per cent) (2010).⁶⁰⁰ Furthermore, indicators for infant and young child feeding are particularly poor for Lao PDR. More than two-thirds (70 per cent) of neonates do not initiate

⁵⁸⁶ World Health Organization, *Nutrition Landscape Information System: country profile*

⁵⁸⁷ te Lintelo, Haddad, Lakshman and Gatelloer

⁵⁸⁸ Food and Agriculture Organization of the United Nations, *FAO—food security indicators*

⁵⁸⁹ United Nations Children's Fund, *Early initiation of breastfeeding (newborns put to the breast within one hour of birth)*

⁵⁹⁰ United Nations Children's Fund, *Infant and young child feeding*

⁵⁹¹ United Nations Statistics Division, *Millennium Development Goals indicators*

⁵⁹² World Health Organization, *Nutrition Landscape Information System: country profile*

⁵⁹³ World Health Organization, *Nutrition Landscape Information System: country profile*

⁵⁹⁴ World Health Organization, *Nutrition Landscape Information System: country profile*

⁵⁹⁵ World Health Organization, *Worldwide prevalence of anaemia 1993–2005: WHO global database on anaemia*

⁵⁹⁶ World Health Organization, *Global prevalence of vitamin A deficiency in populations at risk 1995–2005: WHO global database on vitamin A deficiency*

⁵⁹⁷ United Nations Children's Fund, *Underweight disparities*

⁵⁹⁸ United Nations Children's Fund, *Underweight disparities*

⁵⁹⁹ World Health Organization, *Nutrition Landscape Information System: country profile*

⁶⁰⁰ Food and Agriculture Organization of the United Nations, *FAO—food security indicators*

breastfeeding within 1 hour of birth (2006);⁶⁰¹ almost three-quarters (74 per cent) are not exclusively breastfed until 6 months;⁶⁰² and less than half (41 per cent) receive the recommended introduction to complementary foods by 6–8 months of age.⁶⁰³

Myanmar

- › Progress against MDG1c: the percentage of children under 5 years of age who are underweight decreased from 32.5 per cent (in 1990) to 29.6 per cent (in 2003).⁶⁰⁴

Based on 2009–10 figures, the prevalence of stunting and underweight in Myanmar is high, with 35 per cent of children under 5 years of age stunted and 23 per cent underweight; the prevalence of wasting is ranked medium, with 8 per cent of children under 5 years of age wasted.⁶⁰⁵ Nine per cent of children are born with low birthweight (2009–10 figures).⁶⁰⁶

Young girls are 4 per cent less likely than boys to be underweight (2009–10).⁶⁰⁷ Young children in rural areas are 29 per cent more likely to be underweight than their urban counterparts (2009–10).⁶⁰⁸ The most significant disparities are seen across wealth quintiles, with the poorest children almost two-and-a-half times more likely to be underweight than children from the richest households (risk ratio 2.45; 2009–10).⁶⁰⁹

Myanmar performs poorly against indicators for distal risk factors for child undernutrition. Based on 2011 figures, human development (HDI 0.483)⁶¹⁰ and political stability (–1.16)⁶¹¹ are scored reasonably low. Although Myanmar received a nutrition governance ranking of medium in 2009, the recent HANCI ranked the country at 41 (of 45) (2011 figures).⁶¹² Additionally, more than three-quarters (76 per cent) of infants are not exclusively breastfed for 6 months.⁶¹³

Nepal

- › Progress against MDG1c: the percentage of children under 5 years of age who are underweight decreased from 42.6 per cent (in 1995) to 38.8 per cent (in 2006).⁶¹⁴

Based on 2011 data, the prevalence of stunting in Nepal is very high, at 41 per cent, while the prevalences of underweight and wasting are high, at 29 per cent and 11 per cent, respectively.⁶¹⁵

⁶⁰¹ United Nations Children's Fund, *Early initiation of breastfeeding (newborns put to the breast within one hour of birth)*

⁶⁰² United Nations Children's Fund, *Infant and young child feeding*

⁶⁰³ World Health Organization, *Nutrition Landscape Information System: country profile*

⁶⁰⁴ United Nations Statistics Division, *Millennium Development Goals indicators*

⁶⁰⁵ World Health Organization, *Nutrition Landscape Information System: country profile*

⁶⁰⁶ World Health Organization, *Nutrition Landscape Information System: country profile*

⁶⁰⁷ United Nations Children's Fund, *Underweight disparities*

⁶⁰⁸ United Nations Children's Fund, *Underweight disparities*

⁶⁰⁹ United Nations Children's Fund, *Underweight disparities*

⁶¹⁰ World Health Organization, *Nutrition Landscape Information System: country profile*

⁶¹¹ Food and Agriculture Organization of the United Nations, *FAO—food security indicators*

⁶¹² te Lintelo, Haddad, Lakshman and Gatelloer

⁶¹³ United Nations Children's Fund, *Infant and young child feeding*

⁶¹⁴ United Nations Statistics Division, *Millennium Development Goals indicators*

More than one-fifth (21 per cent) of children are born with low birthweight (2006 figures).⁶¹⁶ Almost half (46 per cent) of children aged 6–59 months of age have anaemia (2011).⁶¹⁷

Between 2006 and 2011, there was an annual reduction in the proportion of children under 5 years of age who are underweight of 1.9 per cent.⁶¹⁸ However, sharp disparities between population groups exist. Young rural children are 82 per cent more likely to be underweight than young urban children, and young children from the poorest households are more than four times more likely to be underweight than children from the richest households (risk ratio 4.03; 2011).⁶¹⁹ Young girls are 5 per cent less likely to be underweight than boys (2011).⁶²⁰

Across several proximal risk factors, Nepal performs poorly. Maternal health and nutrition is poor, with almost one-fifth (18 per cent; 2011) of adult women underweight⁶²¹ and almost half (48 per cent) of pregnant women anaemic (2011).⁶²² Fewer than half (45 per cent; 2011) of neonates initiate breastfeeding within 1 hour of birth.⁶²³

Nepal's performance across key indicators relating to the distal risk factors for child undernutrition is moderate to poor, with an HDI score of 0.458,⁶²⁴ a GII score of 0.558⁶²⁵ and a political stability score of –1.55 (2011).⁶²⁶ Nutrition governance is ranked as medium (2009),⁶²⁷ and Nepal was ranked 18 in the 2011 HANCI index.⁶²⁸ Access to sanitation facilities is 31 per cent (2010).⁶²⁹

Papua New Guinea

- › Progress against MDG1c: a lack of baseline data, and issues with data quality and collection, mean that it is not feasible to indicate progress.⁶³⁰

⁶¹⁵ World Health Organization, *Nutrition Landscape Information System: country profile*

⁶¹⁶ World Health Organization, *Nutrition Landscape Information System: country profile*

⁶¹⁷ World Health Organization, *Worldwide prevalence of anaemia 1993–2005: WHO global database on anaemia*

⁶¹⁸ World Health Organization, *Nutrition Landscape Information System: country profile*

⁶¹⁹ United Nations Children's Fund, *Underweight disparities*

⁶²⁰ United Nations Children's Fund, *Underweight disparities*

⁶²¹ World Health Organization, *Global database on body mass index*

⁶²² World Health Organization, *Worldwide prevalence of anaemia 1993–2005: WHO global database on anaemia*

⁶²³ United Nations Children's Fund, *Early initiation of breastfeeding (newborns put to the breast within one hour of birth)*

⁶²⁴ World Health Organization, *Nutrition Landscape Information System: country profile*

⁶²⁵ World Health Organization, *Nutrition Landscape Information System: country profile*

⁶²⁶ Food and Agriculture Organization of the United Nations, *FAO—food security indicators*

⁶²⁷ World Health Organization, *Nutrition Landscape Information System: country profile*

⁶²⁸ te Lintelo, Haddad, Lakshman and Gatelloer

⁶²⁹ Food and Agriculture Organization of the United Nations, *FAO—food security indicators*

⁶³⁰ Government of Papua New Guinea and United Nations in Papua New Guinea, *Millennium Development Goals: progress report for Papua New Guinea 2004*, Government of Papua New Guinea and United Nations, 2004.

United Nations Statistics Division, *Millennium Development Goals indicators*; Center for Global Development, *MDG Progress Index: gauging country-level achievements*, CGD, accessed 14 May

Based on data from the national nutrition survey in 2005, the prevalence of stunting in children under 5 years of age is very high, at 44 per cent, while the prevalence of underweight is medium, at 18 per cent, and the prevalence of wasting is low, at 4 per cent.⁶³¹ One in 10 babies is born with low birthweight.⁶³² Limited data are available on micronutrient deficiencies, but 1998 figures indicate that 11 per cent of children aged 6–59 months are vitamin A deficient.⁶³³

Young children in rural areas are 60 per cent more likely to be underweight than their urban counterparts (2005 figures).⁶³⁴ No data are available on underweight disparities based on gender or wealth quintiles.⁶³⁵

Papua New Guinea has a low human development score (HDI 0.466),⁶³⁶ a moderately low score for political stability (–0.89)⁶³⁷ and a high score for gender inequality (GII 0.674; 2011).⁶³⁸ Additionally, only 40 per cent of the population has access to improved water sources, the lowest in all countries reviewed here with the exception of Somalia; 45 per cent have access to adequate sanitation facilities (2010).⁶³⁹ Although data from a 2005 national nutrition survey indicate that 84 per cent of neonates initiate breastfeeding within 24 hours of birth,⁶⁴⁰ only 56 per cent of infants are exclusively breastfed until 6 months (2006).⁶⁴¹

The Philippines

- › Progress against MDG1c: the percentage of children under 5 years of age who are underweight decreased from 29.9 per cent (in 1990) to 20.7 per cent (in 2008).⁶⁴²

Based on 2008 data, there is a high prevalence of stunting (32 per cent) and underweight (21 per cent) among children under 5 years of age in the Philippines, while the prevalence of wasting is rated medium, at 7 per cent.⁶⁴³ More than one-fifth (21 per cent) of children are born with low birthweight (2008 figures).⁶⁴⁴ Approximately two-thirds of children aged 6–59 months have anaemia (36 per

2013, <http://international.cgdev.org/page/mdg-progress-index-gauging-country-level-achievements>. Center for Global Development, *MDG Progress Index tool raw data*, CGD, accessed 20 December 2013, www.cgdev.org/userfiles/cms_iframes/mdg_map/mdg_tool_raw_data_09_13_2011.xls 2011.

⁶³¹ World Health Organization, *Nutrition Landscape Information System: country profile*

⁶³² World Health Organization, *Nutrition Landscape Information System: country profile*

⁶³³ World Health Organization, *Global prevalence of vitamin A deficiency in populations at risk 1995–2005: WHO global database on vitamin A deficiency*

⁶³⁴ United Nations Children's Fund, *Underweight disparities*

⁶³⁵ United Nations Children's Fund, *Underweight disparities*

⁶³⁶ World Health Organization, *Nutrition Landscape Information System: country profile*

⁶³⁷ Food and Agriculture Organization of the United Nations, *FAO—food security indicators*

⁶³⁸ World Health Organization, *Nutrition Landscape Information System: country profile*

⁶³⁹ Food and Agriculture Organization of the United Nations, *FAO—food security indicators*

⁶⁴⁰ Department of Health Papua New Guinea, UNICEF, University of Papua New Guinea and Centres for Disease Control and Prevention, Infant and young child feeding. *Pacific Journal of Medical Sciences* 8(2 Special issue: National Nutrition Survey Papua New Guinea, 2005):81–84, 2011.

⁶⁴¹ United Nations Children's Fund, *Infant and young child feeding*

⁶⁴² United Nations Statistics Division, *Millennium Development Goals indicators*

⁶⁴³ World Health Organization, *Nutrition Landscape Information System: country profile*

⁶⁴⁴ World Health Organization, *Nutrition Landscape Information System: country profile*

cent; 2003)⁶⁴⁵ or vitamin A deficiency (40 per cent; 2003).⁶⁴⁶ No data are available on underweight disparities.⁶⁴⁷

The Philippines performs relatively well against indicators reflecting distal risk factors, with a reasonably high HDI score of 0.644 (2011 figures), a moderately low GII score of 0.427 (2011), a nutrition governance ranking of strong (2009)⁶⁴⁸ and a HANCI rank of 6 (of 45) (2011).⁶⁴⁹ Access to water and sanitation facilities is also relatively good, at 92 per cent and 74 per cent, respectively (2010).⁶⁵⁰

However, the Philippines performs poorly against maternal nutrition and health indicators. Adult women are 34 per cent more likely to be underweight than men, with 14 per cent of all adult women underweight (2003 and 2004).⁶⁵¹ Some 44 per cent of pregnant women have anaemia, which reflects poor maternal nutrition and is a predisposing factor for low birthweight.⁶⁵² Additionally, breastfeeding practices are generally poor, with more than 40 per cent of infants not receiving recommended breastfeeding care across all three key indicators (2008).⁶⁵³

Solomon Islands

- › Progress against MDG1c: the percentage of children under 5 years of age who are underweight decreased from 23 per cent (in 1990) to 11.5 per cent (in 2010).⁶⁵⁴

Based on 2006–07 figures, the prevalence of stunting is high, with one-third of children under 5 years of age stunted, while the prevalence of underweight is medium (12 per cent), and the prevalence of wasting is low (4 per cent).⁶⁵⁵ One in eight children (13 per cent) is born with low birthweight (2006–07 figures).⁶⁵⁶

Young girls are 29 per cent more likely to be underweight than young boys (2007 figures).⁶⁵⁷ Young rural children are 49 per cent more likely to be underweight than urban children, and young children

⁶⁴⁵ World Health Organization, *Worldwide prevalence of anaemia 1993–2005: WHO global database on anaemia*

⁶⁴⁶ World Health Organization, *Global prevalence of vitamin A deficiency in populations at risk 1995–2005: WHO global database on vitamin A deficiency*

⁶⁴⁷ United Nations Children's Fund, *Underweight disparities*

⁶⁴⁸ World Health Organization, *Nutrition Landscape Information System: country profile*

⁶⁴⁹ te Lintelo, Haddad, Lakshman and Gatelloer

⁶⁵⁰ Food and Agriculture Organization of the United Nations, *FAO—food security indicators*

⁶⁵¹ World Health Organization, *Global database on body mass index*

⁶⁵² World Health Organization, *Worldwide prevalence of anaemia 1993–2005: WHO global database on anaemia*

⁶⁵³ United Nations Children's Fund, *Infant and young child feeding*; United Nations Children's Fund, *Early initiation of breastfeeding (newborns put to the breast within one hour of birth)*

⁶⁵⁴ United Nations Development Programme, *Millennium Development Goals progress report for Solomon Islands 2010*, 2010.

⁶⁵⁵ World Health Organization, *Nutrition Landscape Information System: country profile*

⁶⁵⁶ World Health Organization, *Nutrition Landscape Information System: country profile*

⁶⁵⁷ United Nations Children's Fund, *Underweight disparities*

from the poorest households are 40 per cent more likely to be underweight than those from the richest households (2007).⁶⁵⁸

Solomon Islands has moderate to low scores for human development (HDI 0.510; 2011)⁶⁵⁹ and political stability (0.34; 2011).⁶⁶⁰ Infant and young child feeding practices are reasonably good: based on 2007 figures, approximately three-quarters of neonates initiate breastfeeding within 1 hour of birth (75 per cent)⁶⁶¹ and are exclusively breastfed until 6 months (74 per cent),⁶⁶² while 84 per cent of infants are breastfed until 1 year of age,⁶⁶³ and more than two-thirds (67 per cent) are breastfed until 2 years of age.⁶⁶⁴

Southeastern Africa

- › Progress against MDG1c: aggregate figures for sub-Saharan Africa indicate that the percentage of children under 5 years of age who are underweight decreased from 29 per cent (in 1990) to 22 per cent (in 2010).⁶⁶⁵

This section collates data relating to Ethiopia, Kenya, Malawi, Mozambique, Somalia, South Sudan, Tanzania, Uganda, Zambia and Zimbabwe. There are very high levels of stunting across the region, with almost half (42–48 per cent) of all children under 5 years of age stunted in the majority of countries.⁶⁶⁶ The exceptions are Kenya (35 per cent stunted; 2008–09 figures), Uganda (34 per cent; 2011) and Zimbabwe (32 per cent; 2010–11).⁶⁶⁷ The prevalence of underweight and wasting is more variable across countries. Most countries had a prevalence of underweight ranked medium (10–18 per cent across countries), with the exception of Ethiopia (ranked high, at 29 per cent; 2010–11) and Somalia (ranked very high, at 33 per cent; 2006).⁶⁶⁸

The prevalence of wasting across most countries was ranked low (3–5 per cent), with the exception of Zambia (ranked medium, at 6 per cent; 2007), Kenya (ranked medium, at 7 per cent; 2005–06), Ethiopia (ranked high, at 10 per cent; 2010–11) and Somalia (ranked high, at 13 per cent; 2006).⁶⁶⁹

The prevalence of low birthweight ranges from a low of 8 per cent in Kenya (2008–09) to a high of 20 per cent in Ethiopia (2005).⁶⁷⁰ For those countries with data on micronutrient deficiencies, with the exception of Zimbabwe, 53–75 per cent of children aged 6–59 months are anaemic,⁶⁷¹ and 24–

⁶⁵⁸ United Nations Children's Fund, *Underweight disparities*

⁶⁵⁹ World Health Organization, *Nutrition Landscape Information System: country profile*

⁶⁶⁰ Food and Agriculture Organization of the United Nations, *FAO—food security indicators*

⁶⁶¹ United Nations Children's Fund, *Early initiation of breastfeeding (newborns put to the breast within one hour of birth)*

⁶⁶² United Nations Children's Fund, *Infant and young child feeding*

⁶⁶³ United Nations Children's Fund, *Infant and young child feeding*

⁶⁶⁴ United Nations Children's Fund, *Infant and young child feeding*

⁶⁶⁵ United Nations, *The Millennium Development Goals report 2012*, United Nations, New York, 2013.

⁶⁶⁶ World Health Organization, *Nutrition Landscape Information System: country profile*

⁶⁶⁷ World Health Organization, *Nutrition Landscape Information System: country profile*

⁶⁶⁸ World Health Organization, *Nutrition Landscape Information System: country profile*

⁶⁶⁹ World Health Organization, *Nutrition Landscape Information System: country profile*

⁶⁷⁰ World Health Organization, *Nutrition Landscape Information System: country profile*

⁶⁷¹ World Health Organization, *Worldwide prevalence of anaemia 1993–2005: WHO global database on anaemia*

84 per cent of young children under 5 years of age are vitamin A deficient.⁶⁷² Based on median urinary iodine concentration, iodine status at population level ranges from moderate deficiency in Ethiopia (25 µg/L; 2005) to excessive intake in Uganda (464 µg/L; 2005).⁶⁷³

Across all countries (with the exception of South Sudan, for which there were no data), young girls were less likely to be underweight than boys by between 8 per cent (Somalia; 2006) and 25 per cent (Zambia; 2007).⁶⁷⁴ Young children in rural areas are more likely to be underweight than their urban counterparts by between 20 per cent (Zambia; 2007) and 226 per cent (Uganda; 2011).⁶⁷⁵ Young children in the poorest households are more likely to be underweight than those from the richest households, with risk ratios varying from 1.29 (Malawi; 2010) to 3.03 (Somalia; 2006).⁶⁷⁶

Performance across indicators for the distal risk factors for child undernutrition is generally poor, but varies substantially across countries. For example, the HANCI ranking of countries varied from 2 (Malawi) to 34 (Kenya) (2011).⁶⁷⁷ The countries in this region are net food exporters,⁶⁷⁸ and have the lowest access to water and sanitation facilities—particularly sanitation—across all countries reviewed.⁶⁷⁹ With the exception of Zimbabwe, in each country for which data are available, approximately half of pregnant women have anaemia;⁶⁸⁰ in each country, including Zimbabwe, at least 9 per cent of adult women are underweight.⁶⁸¹

Timor-Leste

- › Progress against MDG1c: the percentage of children under 5 years of age who are underweight increased from 40.6 per cent (in 2002) to 45.3 per cent (in 2010).⁶⁸²

Based on 2009–10 data, Timor-Leste has a very high prevalence of underweight (44 per cent), stunting (58 per cent) and wasting (19 per cent).⁶⁸³ Some 10 per cent of neonates are born with low birthweight (2009 figures),⁶⁸⁴ and more than one-third (38 per cent) of children aged 6–59 months are anaemic (2009).⁶⁸⁵

Young girls are 4 per cent less likely to be underweight than boys. Children in rural areas are 36 per cent more likely to be underweight than their urban counterparts, and children in the poorest

⁶⁷² World Health Organization, *Global prevalence of vitamin A deficiency in populations at risk 1995–2005: WHO global database on vitamin A deficiency*

⁶⁷³ World Health Organization, *Nutrition Landscape Information System: country profile*

⁶⁷⁴ United Nations Children's Fund, *Underweight disparities*

⁶⁷⁵ United Nations Children's Fund, *Underweight disparities*

⁶⁷⁶ United Nations Children's Fund, *Underweight disparities*

⁶⁷⁷ te Lintelo, Haddad, Lakshman and Gatelloer

⁶⁷⁸ World Health Organization, *Nutrition Landscape Information System: country profile*

⁶⁷⁹ Food and Agriculture Organization of the United Nations, *FAO—food security indicators*

⁶⁸⁰ World Health Organization, *Worldwide prevalence of anaemia 1993–2005: WHO global database on anaemia*

⁶⁸¹ World Health Organization, *Global database on body mass index*

⁶⁸² United Nations Statistics Division, *Millennium Development Goals indicators*

⁶⁸³ World Health Organization, *Nutrition Landscape Information System: country profile*

⁶⁸⁴ World Health Organization, *Nutrition Landscape Information System: country profile*

⁶⁸⁵ World Health Organization, *Worldwide prevalence of anaemia 1993–2005: WHO global database on anaemia*

households are 40 per cent more likely to be underweight than their counterparts from the richest households (2009–10).⁶⁸⁶

Infant and young child feeding practices are variable, with 2009–10 figures revealing relatively high rates of breastfeeding initiation (82 per cent),⁶⁸⁷ while the rate of exclusive breastfeeding until 6 months is 52 per cent.⁶⁸⁸ Poor maternal nutrition and health is a major health issue: 27 per cent of adult women are underweight (2009),⁶⁸⁹ and 21 per cent of pregnant women are anaemic (2003).⁶⁹⁰

Data for many of the distal risk factors are not available, although the HDI score of 0.495 (2011)⁶⁹¹ indicates a moderately low level of basic services. Just over one-third (31 per cent) of the population has access to an improved water source, while less than half (47 per cent) has access to adequate sanitation facilities (2010).⁶⁹²

Vanuatu

- › Progress against MDG1c: the percentage of children under 5 years of age who are underweight increased from 10.6 per cent (in 1996) to 11.7 per cent (in 2007).⁶⁹³

Based on 2007 figures for Vanuatu, the prevalences in children under 5 years of age of stunting (26 per cent), underweight (12 per cent) and wasting (6 per cent) are medium.⁶⁹⁴ One in 10 children (10 per cent) is born with low birthweight (2007 figures).⁶⁹⁵

Girl children are 40 per cent less likely to be underweight than boy children (2007).⁶⁹⁶ There are minimal differences in the prevalence of underweight between rural and urban children (risk ratio 0.96), and children from the poorest households are 18 per cent more likely to be underweight than those from the richest households (2007).⁶⁹⁷

Vanuatu has reasonably high scores for human development (HDI 0.617; 2011)⁶⁹⁸ and political stability (1.13; 2011).⁶⁹⁹ However, although access to improved water sources is reasonably high (90 per cent), access to adequate sanitation facilities is low (57 per cent) (2010).⁷⁰⁰ Additionally, based on 2007 figures, more than one-quarter (28 per cent) of children do not initiate breastfeeding

⁶⁸⁶ United Nations Children's Fund, *Underweight disparities*

⁶⁸⁷ United Nations Children's Fund, *Early initiation of breastfeeding (newborns put to the breast within one hour of birth)*

⁶⁸⁸ United Nations Children's Fund, *Infant and young child feeding*

⁶⁸⁹ World Health Organization, *Global database on body mass index*

⁶⁹⁰ World Health Organization, *Worldwide prevalence of anaemia 1993–2005: WHO global database on anaemia*

⁶⁹¹ World Health Organization, *Nutrition Landscape Information System: country profile*

⁶⁹² Food and Agriculture Organization of the United Nations, *FAO—food security indicators*

⁶⁹³ United Nations Statistics Division, *Millennium Development Goals indicators*

⁶⁹⁴ World Health Organization, *Nutrition Landscape Information System: country profile*

⁶⁹⁵ World Health Organization, *Nutrition Landscape Information System: country profile*

⁶⁹⁶ United Nations Children's Fund, *Underweight disparities*

⁶⁹⁷ United Nations Children's Fund, *Underweight disparities*

⁶⁹⁸ World Health Organization, *Nutrition Landscape Information System: country profile*

⁶⁹⁹ Food and Agriculture Organization of the United Nations, *FAO—food security indicators*

⁷⁰⁰ Food and Agriculture Organization of the United Nations, *FAO—food security indicators*

within 1 hour of birth,⁷⁰¹ almost two-thirds (60 per cent) are not exclusively breastfed until 6 months,⁷⁰² and almost one-third (32 per cent) do not receive the recommended introduction to complementary foods by 6–8 months of age.⁷⁰³

⁷⁰¹ United Nations Children's Fund, *Early initiation of breastfeeding (newborns put to the breast within one hour of birth)*

⁷⁰² United Nations Children's Fund, *Infant and young child feeding*

⁷⁰³ World Health Organization, *Nutrition Landscape Information System: country profile*

15 Overweight children

The World Health Organization estimates that, globally, more than 42 million children under the age of 5 years were overweight in 2010. Close to 35 million of these are in developing countries.⁷⁰⁴

A recent systematic review found that the worldwide prevalence of childhood overweight and obesity increased from 4.2 per cent in 1990 to 6.7 per cent in 2010. This trend is expected to reach 9.1 per cent—around 60 million children—in 2020. The estimated prevalence of childhood overweight and obesity in Africa was 8.5 per cent (7.6 per cent in southern Africa) in 2010 and is expected to reach 12.7 per cent in 2020. The prevalence is lower in Asia (4.9 per cent in 2010) than in Africa, but the number of affected children (18 million) is higher. Based on studies in seven Pacific countries (excluding Australia and New Zealand), the authors estimated that the prevalence of childhood overweight and obesity in the Pacific region was 3.5 per cent in 2010, the equal lowest prevalence of all United Nations regions. The region with the highest prevalence was northern Africa (17 per cent).⁷⁰⁵

⁷⁰⁴ World Health Organization, *Childhood overweight and obesity*, WHO, accessed 24 May 2013, www.who.int/dietphysicalactivity/childhood/en/.

⁷⁰⁵ M de Onis, M Blossner and E Borghi, Global prevalence and trends of overweight and obesity in pre-school children. *American Journal of Clinical Nutrition* 92(5):1257–1264, 2010.

16 Conclusion

This evidence review will form the basis of a forthcoming evaluation of Australia's support for child undernutrition.

Appendix 1 Cost-effectiveness of interventions

Intervention	Target	Type of intervention	Impact	Cost per participant (\$US)	Benefit: cost ratio	Cost-effectiveness (US\$ per DALY averted)	Reference ^a
<i>Nutrition-specific interventions</i>							
Exclusive breastfeeding promotion	Infants	Education only	10–13% reduction in deaths of children <5 years	0.30–0.40	Not available	3–11	R Laxminarayan, J Chow, SA Shahid-Salles, D Jamison, J Breman, A Measham, G Alleyne, M Claeson, D Evans and P Jha, Intervention cost-effectiveness: overview of main messages. In: <i>Disease control priorities in developing countries</i> , D Jamison, J Breman, A Measham, G Alleyne, M Claeson, D Evans, P Jha, A Mills and P Musgrove (eds), 2nd edition, World Bank, Washington, DC, 2006, 35–86. G Jones, RW Steketee, RE Black, ZA Bhutta and SS Morris, How many child deaths can we prevent this year? <i>Lancet</i> 362(9377):65–71, 2003.
	Lactating mothers and children <6 months	Integrated breastfeeding support programs (e.g. including community-based management of respiratory infections)		Not available	Not available	221–568	
Complementary feeding	Children >6 months	Education to mothers on the appropriate complementary feeding practices (in addition to breastfeeding) using platforms such as community nutrition programs	Effective	Not available	Not available	Not available	R Laxminarayan, J Chow, SA Shahid-Salles, D Jamison, J Breman, A Measham, G Alleyne, M Claeson, D Evans and P Jha, Intervention cost-effectiveness: overview of main messages. In: <i>Disease control priorities in developing countries</i> , D Jamison, J Breman, A Measham, G Alleyne, M Claeson, D Evans, P Jha, A Mills and P Musgrove (eds), 2nd edition, World Bank, Washington, DC, 2006, 35–86. KF Michaelsen, L Weaver, F Branca and A Robertson, <i>Feeding and nutrition of infants and young children: guidelines for the WHO European Region, with emphasis on the former Soviet</i>
		Education to mothers with growth monitoring and promotion	Reduction in deaths of children <5 years by about 6%	Not available	Not available	Cost-effective	

Intervention	Target	Type of intervention	Impact	Cost per participant (\$US)	Benefit: cost ratio	Cost-effectiveness (US\$ per DALY averted)	Reference ^a
Water supply, sanitation and hygiene promotion	Households	Hygiene promotion (e.g. hand-washing)	Up to a 43% reduction in diarrhoea morbidity and a 48% reduction in life-threatening cases of diarrhoea	Not available	Not available	3.35	countries, WHO regional publications, European series 87, World Health Organization, Copenhagen, 2000. G Jones, RW Steketee, RE Black, ZA Bhutta and SS Morris, How many child deaths can we prevent this year? <i>Lancet</i> 362(9377):65–71, 2003.
		Oral rehydration therapy	Reduction in deaths of children <5 years by about 10%	Not available	Not available	23	S Cairncross and V Valdmanis, Water supply, sanitation, and hygiene promotion. In: <i>Disease control priorities in developing countries</i> , D Jamison, J Breman, A Measham, G Alleyne, M Claeson, D Evans, P Jha, A Mills and P Musgrove (eds), 2nd edition edition, World Bank and Oxford University Press, New York, 2006, 771–792. L Fewtrell, R Kaufmann, D Kay, W Enanoria, L Haller and J Colford, Water, sanitation, and hygiene interventions to reduce diarrhoea in less developed countries: a systematic review and meta-analysis. <i>Lancet Infectious Diseases</i> 5:42–52, 2005.
		Promotion and social marketing of latrines	Not available	Not available	Not available	11.15	S Cairncross and V Valdmanis, Water supply, sanitation, and hygiene promotion. In: <i>Disease control priorities in developing countries</i> , D Jamison, J Breman, A Measham, G Alleyne, M Claeson, D Evans, P Jha, A Mills and P Musgrove (eds), 2nd edition edition, World Bank and Oxford University Press, New York, 2006, 771–792. G Jones, RW Steketee, RE Black, ZA Bhutta and SS Morris, How many child deaths can we prevent this year? <i>Lancet</i> 362(9377):65–71, 2003.

Intervention	Target	Type of intervention	Impact	Cost per participant (\$US)	Benefit: cost ratio	Cost-effectiveness (US\$ per DALY averted)	Reference ^a
		Water supply—hand pump or stand-post	17% reduction in the incidence of diarrhoea	Not available	Not available	94.00	promotion. In: <i>Disease control priorities in developing countries</i> , D Jamison, J Breman, A Measham, G Alleyne, M Claeson, D Evans, P Jha, A Mills and P Musgrove (eds), 2nd edition edition, World Bank and Oxford University Press, New York, 2006, 771–792. S Cairncross and V Valdmanis, Water supply, sanitation, and hygiene promotion. In: <i>Disease control priorities in developing countries</i> , D Jamison, J Breman, A Measham, G Alleyne, M Claeson, D Evans, P Jha, A Mills and P Musgrove (eds), 2nd edition edition, World Bank and Oxford University Press, New York, 2006, 771–792.
		Water supply—house connection	63% reduction in the incidence of diarrhoea	Not available	Not available	223	S Cairncross and V Valdmanis, Water supply, sanitation, and hygiene promotion. In: <i>Disease control priorities in developing countries</i> , D Jamison, J Breman, A Measham, G Alleyne, M Claeson, D Evans, P Jha, A Mills and P Musgrove (eds), 2nd edition edition, World Bank and Oxford University Press, New York, 2006, 771–792.
Vitamin A	Preschool	Supplementation	30% reduction in all-cause mortality; 39% reduction in deaths from diarrhoeal diseases; 70% reduction in deaths from respiratory disease; 34% reduction in deaths from other causes 30% reduction in diarrhoea-specific mortality in children <5 years Neonatal vitamin A supplementation results in a 20% reduction in infant	1.01–2.55	100:1	6–12	R Laxminarayan, J Chow, SA Shahid-Salles, D Jamison, J Breman, A Measham, G Alleyne, M Claeson, D Evans and P Jha, Intervention cost-effectiveness: overview of main messages. In: <i>Disease control priorities in developing countries</i> , D Jamison, J Breman, A Measham, G Alleyne, M Claeson, D Evans, P Jha, A Mills and P Musgrove (eds), 2nd edition, World Bank, Washington, DC, 2006, 35–86. P Glasziou and D Mackerras, Vitamin A supplementation in infectious diseases:

Intervention	Target	Type of intervention	Impact	Cost per participant (\$US)	Benefit: cost ratio	Cost-effectiveness (US\$ per DALY averted)	Reference ^a
			mortality				a meta-analysis. <i>BMJ</i> 306(6874):366–370, 1993. A Sommer, E Djunaedi, A Loeden, I Tarwotjo, K West, R Tilden and L Mele, Impact of vitamin A supplementation on childhood mortality: a randomised controlled community trial. <i>Lancet</i> 327(8491):1169–1173, 1986. Disease Control Priorities Project, <i>Eliminating malnutrition could reduce poor countries' disease burden by one-third</i> , DCP, Washington, DC, 2007.
	Children	Supplementation, with measles immunisation	50–62% reduction in measles mortality	Not available	Not available	1–5	A Coutoudis, M Broughton and HM Coovadia, Vitamin A supplementation reduces measles morbidity in young African children: a randomized, placebo-controlled, double-blind trial. <i>American Journal of Clinical Nutrition</i> 54(5):890–895, 1991. CR Sudfeld, AM Navar and NA Halsey, Effectiveness of measles vaccination and vitamin A treatment. <i>International Journal of Epidemiology</i> 39(Suppl 1):i48–i55, 2010.
	All	Universal food fortification	Not available	0.05–0.15	Not available	33–35	D Jamison, J Breman, A Measham, G Alleyne, M Claeson, D Evans, P Jha, A Mills and P Musgrove (eds), <i>Disease control priorities in developing countries</i> , 2nd edition, World Bank and Oxford University Press, New York, 771–792, 2006.
Therapeutic zinc supplements	Children	Supplementation	Reduction in deaths of children <5 years by about 4% 20% reduction in mean duration of diarrhoea Significant and positive	1	13.8:1	73	G Jones, RW Steketee, RE Black, ZA Bhutta and SS Morris, How many child deaths can we prevent this year? <i>Lancet</i> 362(9377):65–71, 2003. Disease Control Priorities Project, <i>Eliminating malnutrition could reduce poor countries' disease burden by one-</i>

Intervention	Target	Type of intervention	Impact	Cost per participant (\$US)	Benefit: cost ratio	Cost-effectiveness (US\$ per DALY averted)	Reference ^a
Deworming	Children	Treatment	effect on linear growth	0.5	6:1	2–9	<i>third</i> , DCP, Washington, DC, 2007.
			If the prevalence of soil-transmitted helminths is 50% or more, deworming leads to significant extra gains in weight, height, mid-upper arm circumference and skinfold thickness				World Health Organization, Deworming to combat the health and nutritional impact of soil-transmitted helminths. <i>e-Library of Evidence for Nutrition Actions</i> March 2012.
			In schools, deworming leads to an additional 13.9 years of education for every \$100 spent Deworming children at school decreases absenteeism by 25% Blanket campaigns had little or no impact on haemoglobin, cognition, school attendance or school performance				I Dhaliwal, E Duflo, R Glennerster and C Tulloch, <i>Comparative cost-effectiveness analysis to inform policy in developing countries: a feneral framework with applications for education</i> , Abdul Latif Jameel Poverty Action Lab, Massachusetts Institute of Technology, Cambridge, 2012. Disease Control Priorities Project, <i>Eliminating malnutrition could reduce poor countries' disease burden by one-third</i> , DCP, Washington, DC, 2007.
Iron	Pregnancy	Supplementation during pregnancy	Daily iron–folate supplementation results in 73% reduction in the incidence of anaemia at term and 67% reduction in iron deficiency anaemia at term	1.70	Not available	800	MY Yakoob and Z Bhutta, Effect of routine iron supplementation with or without folic acid on anemia during pregnancy. <i>BMC Public Health</i> 11(Suppl 3):S21, 2011. Disease Control Priorities Project, <i>Eliminating malnutrition could reduce poor countries' disease burden by one-third</i> , DCP, Washington, DC, 2007.
	All	Universal food fortification	Not available	0.12	7.8:1	66–70	R Laxminarayan, J Chow, SA Shahid-Salles, D Jamison, J Breman, A Measham, G Alleyne, M Claeson, D Evans and P Jha, Intervention cost-effectiveness: overview of main messages. In: <i>Disease control priorities in developing countries</i> , D Jamison, J Breman, A Measham, G Alleyne, M

Intervention	Target	Type of intervention	Impact	Cost per participant (\$US)	Benefit: cost ratio	Cost-effectiveness (US\$ per DALY averted)	Reference ^a
Iodine	All	Universal salt iodisation (all)	Reduction in fetal wastage and cretinism; increased cognition in children	0.20–0.50	30:1	34–36	Claeson, D Evans, P Jha, A Mills and P Musgrove (eds), 2nd edition, World Bank, Washington, DC, 2006, 35–86.
	Women of reproductive age	Supplementation with iodised oil capsules		0.5	35:1	1250	Disease Control Priorities Project, <i>Eliminating malnutrition could reduce poor countries' disease burden by one-third</i> , DCP, Washington, DC, 2007.
Community-based nutrition promotion and feed programs	Community	Nutrition education and counselling	Increased nutritional awareness among mothers, and 4.7% reduction in the incidence of wasting within 12 months	1.60–10	Not available	8–11	S Horton, M Shekar, C McDonald, A Mahal and J Brooks, <i>Scaling up nutrition: what will it cost?</i> , World Bank, Washington, DC, 2010.
		Nutrition education with supplementary feeding for management of malnutrition		5–7	12.5:1	80	S Horton, M Shekar, C McDonald, A Mahal and J Brooks, <i>Scaling up nutrition: what will it cost?</i> , World Bank, Washington, DC, 2010.
Biofortification of staple foods	Community	Food crops bred for higher micronutrient content	Increased micronutrient intake	<0.01	Not available	Not available	P Nestel, H Bouis, J Meenakshi and W Pfeiffer, Biofortification of staple food crops. <i>Journal of Nutrition</i> 136:1064–1067, 2006.
Balanced energy and protein supplements during pregnancy	Pregnant women	Biscuits or seeds and oils mixes, distributed by lay health workers or via outreach	38% reduction in stillbirths; 32% reduction in low birthweight among undernourished women; 31% reduction in the risk of giving birth to small-for-gestational-age infants Weight gain among undernourished women No effect on neonatal mortality rate (RR = 0.68, 95%CI 0.43–1.07), preterm birth (RR = 0.96, 95%CI 0.8–1.16) ^b or pre-eclampsia	Not available	Not available	>1000 per maternal, neonatal and child DALY averted	E Ota, R Tobe-Gai, R Mori and D Farrar, Antenatal dietary advice and supplementation to increase energy and protein intake. <i>Cochrane Database of Systematic Reviews</i> (9):CD000032, 2012. ZA Bhutta, T Ahmed, RE Black, S Cousens, K Dewey, E Giugliani, BA Haider, B Kirkwood, S Morris, H Sachdev and M Shekar, What works? Interventions for maternal and child undernutrition and survival. <i>Lancet</i> 371:417–440, 2008. ZA Bhutta, S Ali, S Cousens, TM Ali, BA

Intervention	Target	Type of intervention	Impact	Cost per participant (\$US)	Benefit: cost ratio	Cost-effectiveness (US\$ per DALY averted)	Reference ^a
			(RR = 1.48, 95%CI 0.82–2.66)				Haider, A Rizvi, P Okong, SZ Bhutta and RE Black, Interventions to address maternal, newborn, and child survival: what difference can integrated primary health care strategies make? <i>Lancet</i> 372(9642):972–989, 2008. A Imdad and ZA Bhutta, Effect of balanced protein energy supplementation during pregnancy on birth outcomes. <i>BMC Public Health</i> 11(Suppl 3):S17, 2011.
Supplementary feeding for adolescent girls	Adolescents	Supplements—to improve the current nutritional status of adolescents, as well as improving iron stores	Improved iron and folic acid status; effects on anthropometry still contentious (limited data)	Not available	Not available	13–24	S Horton, M Shekar, C McDonald, A Mahal and J Brooks, <i>Scaling up nutrition: what will it cost?</i> , World Bank, Washington, DC, 2010.
Malaria prevention during pregnancy in endemic areas	Pregnant women	Essential newborn care: warmth, breastfeeding, cleanliness, cord and eye care, and immunisations	Prevention of intrauterine growth restriction and low birthweight	3.00–5.00	Not available	92–148	R Laxminarayan, J Chow, SA Shahid-Salles, D Jamison, J Breman, A Measham, G Alleyne, M Claeson, D Evans and P Jha, Intervention cost-effectiveness: overview of main messages. In: <i>Disease control priorities in developing countries</i> , D Jamison, J Breman, A Measham, G Alleyne, M Claeson, D Evans, P Jha, A Mills and P Musgrove (eds), 2nd edition, World Bank, Washington, DC, 2006, 35–86. H Guyatt and R Snow, Impact of malaria during pregnancy on low birth weight in sub-Saharan Africa. <i>Clinical Microbiology Reviews</i> 17(4):760–769, 2004.
Newborn health care interventions	Neonates	Prenatal and delivery care	Reduction in neonatal and infant mortality by approximately 50% among malnourished children	Not available	Not available	82–142	NV Yinger and El Ransom, <i>Why invest in newborn health</i> , Save the Children and Population Reference Bureau, Washington, DC, 2003. AT Bang, RA Bang, SB Baitule, MH Reddy and MD Deshmukh, Effect of home-based neonatal care and

Intervention	Target	Type of intervention	Impact	Cost per participant (\$US)	Benefit: cost ratio	Cost-effectiveness (US\$ per DALY averted)	Reference ^a
							management of sepsis on neonatal mortality: field trial in rural India. <i>Lancet</i> 354(9194):1955–1961, 1999. J Lawn, B McCarthy and S Ross, Interventions for newborn health and lessons learned. In: <i>The healthy newborn: a reference manual for program managers</i> (eds), CARE and World Health Organization Collaborating Centre in Reproductive Health, 4.2–4.114.
<i>Nutrition-sensitive interventions</i>							
Family planning programs	Women of reproductive age	Education and contraceptive measures	Could prevent 20–40% of all infant deaths by preventing mistimed and underspaced births If all birth intervals of less than 2 years were prevented, child mortality levels would be reduced by an average of 17%	Not available	Not available	40–60	K Kost, DJ Landry and JE Darroch, The effects of pregnancy planning status on birth outcomes and infant care. <i>Family Planning Perspectives</i> :223–230, 1998.
Conditional cash transfer (e.g. Mexico's Oportunidades)	Families, mainly mothers	Monetary transfer conditional on a particular behaviour or action, such as making a visit to a health facility for regular check-ups	Significant increase in the uptake of antenatal care, routine well-child check-ups, and growth monitoring visits for children, by 18%, 19% and 15%, respectively Positive impact on health care utilisation, with a 19.5% increase after 1 year and an 11% increase after 2 years in the proportion of infants (0–3 years) taken to health centres in the past 6 months Reduction in the magnitude of stunting (net average	Not available	Not available	Not available	J Maluccio and R Flores, <i>Impact evaluation of a conditional cash transfer program: the Nicaraguan Red de Protección Social</i> , FCND discussion paper 184, International Food Policy Research Institute, Washington, DC, 2005. J Behrman, P Segupta and P Todd, <i>Progressing through PROGRESA: an impact assessment of a school subsidy experiment</i> , PIER working paper 01-033, Penn Institute for Economic Research, Philadelphia, 2001. JR Behrman, SW Parker and PE Todd, Do conditional cash transfers for schooling generate lasting benefits? A

Intervention	Target	Type of intervention	Impact	Cost per participant (\$US)	Benefit: cost ratio	Cost-effectiveness (US\$ per DALY averted)	Reference ^a
			improvement in the height-for-age z-score by 0.17) and the proportion of underweight children aged 0–5 years (net impact of 6% after 2 years). No impact on wasting				five-year followup of PROGRESA/oportunidades. <i>Journal of Human Resources</i> 46(1):93–122, 2011.
Social transfer (e.g. South Africa's Child Support Grant)	Families and community	Tax-financed (and/or aid-supported) policy instruments designed to address poverty and vulnerability	Improvement in height for age of children 0–24 months, but not of children 24–72 months (Colombia) Positive impacts on height for age in children 0–36 months (South Africa and Ecuador) 5.2% reduction in stunting among children <5 years in Nicaragua, but no impact in Mexico 127.3 g higher birthweight and 4.6% reduction in low birthweight in Mexico No impact on weight for age or weight for height	Not available	1.4–2.5:1	53–153	A Barrientos, Social transfers and growth: what do we know? What do we need to find out? <i>World Development</i> 40(1):11–20, 2012. M Niño-Zarazúa, <i>Social transfers against poverty and malnutrition: what do we know about their effectiveness?</i> , World Institute for Development Economics Research, United Nations University, Place Published, 2011, www.wider.unu.edu/events/research-presentations/seminars/en_GB/03-04-2012/ .
Social protection system (e.g. Bangladesh/BRAC's Challenging the Frontiers of Poverty Reduction)	Families and community	Elimination of user fees Entitlements, e.g. provision of income (cash) or consumption (food); transfers to the poor, such as food for work Protection of the vulnerable against livelihood risks, such as food price stabilisation Enhancement of the social status and rights of the excluded and marginalised	Households receiving cash transfers are 52% more likely to achieve food security, with chronic malnutrition falling by approximately 30% among children <6 years and by approximately 62% in infants 6–11 months (Brazil) 9% reduction in stunting and 2.2% reduction in wasting (Malawi)	Not available	Not available	Not available	High Level Panel of Experts, <i>Social protection for food security: a report by the High Level Panel of Experts on Food Security and Nutrition</i> , HLPE report 4, Committee on World Food Security, Rome, 2012.

Intervention	Target	Type of intervention	Impact	Cost per participant (\$US)	Benefit: cost ratio	Cost-effectiveness (US\$ per DALY averted)	Reference ^a
Home garden program (e.g. Helen Keller Institute's Homestead Food Production program)	Households	Demonstration vegetable gardens Genetic improvement of vegetables AVRDC—the World Vegetable Center's Approach to Alleviate Malnutrition	Favourable effect on maternal knowledge of vitamin A nutrition, and dietary intake of pro-vitamin A-rich vegetables	Not available	Not available	Not available	M Faber and S Laurie, A home gardening approach developed in South Africa to address vitamin A deficiency. In: <i>Combating micronutrient deficiencies: food-based approaches</i> , B Thompson and L Amoroso (eds), CAB International and Food and Agriculture Organization of the United Nations, Rome, 2011, 163–182.

CI = confidence interval; DALY = disability-adjusted life year; RR = relative risk

^a These references are for both impact and cost-effectiveness data

^b Only two out of five studies were conducted in low- and middle-income countries.

Appendix 2 Selected agricultural development interventions and their links with child nutrition

Country	Intervention	Nutrition data collected	Findings
Bangladesh	Homestead gardening with provision of seeds, farming education and nutrition education	Yes	Slight decrease in night blindness, indicating improved vitamin A status
Bangladesh	Homestead gardening with vegetables, training in agriculture, and provision of seeds and nutrition education	Yes	Improvements in stunting and in underweight
Bangladesh	Vegetable production, fish ponds, and credit and agricultural training	Yes	No change in haemoglobin in any group, implying no change in iron status
Ethiopia	Training in agriculture; food preparation sessions; and provision of seeds, and health and nutrition education	Yes	Lower prevalence of clinical signs of vitamin A deficiency in treatment area
Guatemala	Provision of seeds, extension services and nutrition education for the promotion of vitamin A-rich foods	No	No data collected on nutrition indicators (only dietary indicators)
India	Homestead gardening and nutrition and health education	Yes	Decrease in ocular signs and symptoms of vitamin A deficiency
Indonesia	Social marketing with mass media and 1-on-1 communication to increase intake of targeted vitamin A-rich foods	Yes	Increased serum retinol with increased egg consumption; dose-response relationship indicated improved vitamin A status
Kenya	Introduction of a new variety of sweet potatoes, training in food-processing techniques and nutrition education	No	No data collected on nutrition indicators (only dietary indicators)
Nepal	Homestead gardening, irrigation, agriculture extension and provision of seeds	Yes	Deterioration of nutritional status of children during study (no control)
Nepal	Promotion of home production, and multimedia education campaign promoting consumption of vitamin A-rich foods	No	No data collected on nutrition indicators (only dietary indicators)
Peru	Nutrition education in community kitchen with capacity building	Yes	Reduction in prevalence of anemia
Philippines	Promotion of production of vitamin A-rich fruits and vegetables, with provision of seeds and seedlings, and advice on agricultural practices	Yes	Improved weight-for-height and decrease in severe wasting. No change in serum retinol or clinical eye signs of severe vitamin A deficiency
Philippines	Promotion of homestead gardens, provision of seeds and cuttings, mass media campaigns, social marketing and nutrition education	No	No data collected on nutrition indicators (only dietary indicators)
Senegal	Promotion of homestead gardens and sale of produce, and provision of nutrition and agriculture education	No	No data collected on nutrition indicators (only dietary indicators)

Country	Intervention	Nutrition data collected	Findings
Tanzania	Promotion of home production, consumption and storage of vitamin A-rich foods; and health and nutrition education	Yes	Lower serum vitamin A and higher helminths in treatment area. (Overall, higher intake of vitamin A-rich foods, associated with higher serum vitamin A)
Tanzania	Promotion of solar driers; nutrition and health education	No	No data collected on nutrition indicators (only dietary indicators)
Thailand	Seed distribution; training of women farmers; promotion of gardens, fish ponds and raising chickens; nutrition education; and social marketing	Yes	Increased serum retinol and decreased vitamin A deficiency (in schoolgirls). Increased mean hemoglobin and decreased anemia
Vietnam	Homestead gardens, fish ponds, and animal husbandry and nutrition education	No	No data collected on nutrition indicators (only dietary indicators)
Vietnam	Promotion of homestead gardens with a focus on vitamin A-rich crops, and nutrition education for mothers	Yes	Clinical eye signs of severe vitamin A deficiency decreased to almost zero, implying improved vitamin A status

Source: World Bank, *From agriculture to nutrition: pathways, synergies and outcomes*, World Bank, Washington, DC, 2007.

Appendix 3 Child nutrition status data summary table

See separate file or click on the icon below



Child nutrition status
data summary table

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