



The Case for Investment in Nutrition in Sudan

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Contents

Acronyms.....	1
Executive Summary.....	2
1 Introduction.....	3
2 Investment Case: The Problem and How it Can Be Addressed.....	5
3 Some Key Contributing Factors to High Malnutrition Rates in Sudan.....	10
4 Why Invest in Nutrition in Sudan?	15
5 Results and Impact Analysis	24
6 Funding Gap.....	34
7 Implementation.....	36
8 Conclusion.....	38
Further Reading.....	39
Appendix 1.....	39

Acronyms

CMAM	Community-based management of acute malnutrition
FAO	Food and Agriculture Organization of the United Nations
GAM	Global acute malnutrition
GDP	Gross domestic product
IFAD	International Fund for Agricultural Development
LiST	Lives saved tool
MAM	Moderate acute malnutrition
MDG	Millennium Development Goals
MoU	Memorandum of Understanding
OCHA	Office for the Coordination of Humanitarian Affairs
OHT	OneHealth tool
SAM	Severe acute malnutrition
SHHS	Sudan household survey
SUN	Scaling up nutrition
WASH	Water, sanitation and hygiene
WFP	World Food Programme
WHO	World Health Organization



Executive Summary

This paper presents the case for substantial investment to reduce undernutrition in Sudan.

Undernutrition is one of the country's most serious, but least addressed, socioeconomic and health problems. Yet efforts to address the problem barely scratch the surface. People's health suffers from a lack of awareness about the consequences of and solutions to undernutrition. In addition, the country's operational and financial capacity to develop and implement a comprehensive nutrition policy is extremely limited. Expenditure on nutrition is often too low to get sustainable results. Most of the donor funding for nutrition in Sudan is for short-term support of humanitarian action with limited longer-term outcomes. The result of insufficient investment in nutrition over the past 30 years is that the country has missed opportunities for development and economic progress. Surprisingly, given the stage of the country's economic development, the nutritional status of children is particularly poor.

This paper explains how to scale up high impact, cost-effective nutrition interventions within the National Nutrition Strategic Plan 2014–2018 to reduce the very high undernutrition burden of Sudanese children, adolescents and women. The paper analyses what could happen under four scenarios:

- Business as usual (maintaining the status quo)
- Implementing a UNICEF/WFP plan to scale up investment in reducing undernutrition, initially in five states
- Scaling up investment in reducing undernutrition to cover 50 per cent of Sudan
- Scaling up investment in reducing undernutrition to cover 90 per cent of Sudan.

The analysis of the four scenarios with the lives saved tool (LiST) – an evidence-based modelling software – shows that scaling up a package of selected nutrition-specific and nutrition-sensitive interventions to cover **90 per cent of Sudan**, would be the **most cost-effective investment** for reducing undernutrition and under-five mortality in Sudan. An investment package that covers 90 per cent of Sudan would result in more lives saved and would avert more cases of stunting compared to the other packages.

Over the period 2015 to 2019, scaling up a package of selected nutrition-specific and nutrition-sensitive interventions to cover **90 per cent of Sudan** would:

- **Reduce the under-five mortality rate** to 49/1,000 live births
- **Reduce the prevalence of stunting** to 25 per cent
- **Reduce the prevalence of wasting** (global acute malnutrition – GAM) to 6 per cent
- **Increase exclusive breastfeeding** to 63 per cent
- **Reduce iron deficiency anaemia among pregnant women** to 26 per cent.

The **total cost of reaching 90 per cent of Sudan** with a package of selected nutrition-specific and nutrition-sensitive interventions would be **US\$524 million a year** – an increase of US\$443 million on the US\$81 million currently spent.

Studies show that investment in improving nutrition can raise a country's gross domestic product (GDP) by 3 per cent a year. On the basis of Sudan's **2013 GDP of US\$66.55 billion**, this would translate into a gain for Sudan of **US\$2 billion a year**. The value of the benefit would be substantially more than the cost and would represent a fourfold return on investment.

The estimate of the benefits to Sudan from the investment of **US\$524 million a year** are extremely conservative as the lives saved tool does not take into account the impact of all the nutrition-sensitive interventions that would be included in the package to reduce undernutrition to cover 90 per cent of Sudan.

1. Introduction



1.1 Background

Sudan has a land area of 1,861,484 km² and it shares borders with seven countries – Egypt, Eritrea, Ethiopia, South Sudan, Central African Republic, Chad and Libya – as well as the Red Sea. The country is generally flat, with mountains in the northeast and west, while the desert dominates the north. The Nile River divides the country into eastern and western halves¹.

Sudan comprises 18 states. Each state is divided into localities, the total number of localities is 184². The climate ranges from tropical in the south to arid desert in the north. Natural disasters have had adverse effects in many states. About 18 per cent of the population is severely affected by floods every year during the rainy season (June to September). Drought also constitutes a real hazard for food security in certain states, like West and South Darfur, affecting about 10 per cent of the population. Some parts of the country experience heat waves while others have dust storms, earthquakes and landslides.

Epidemics constitute a threat to the health and wellbeing of the population. Meningitis is the most common epidemic as the country is situated in the 'meningitis belt'. The geography and ecology contribute to the prevailing health, nutrition and population situations. The vast geographic areas, coupled with inadequate road and transport infrastructure, affect coverage and access to health services. Despite some improvements in recent years, Sudan ranks among the top 10 countries in the Eastern Mediterranean Region with the highest child and maternal mortality rates.

1.2 Demography

Using the 2008 census data and an annual growth rate of 2.8 per cent, the total population by 2014 is projected to be about 37.4 million. Of these, 88 per cent are settled (with about 33 per cent of these located in urban areas) and 8 per cent are nomads. Almost 7 per cent of the population is internally displaced. Natural disasters, civil conflicts and poor conditions in

¹ Collins, R.O., *A History of Modern Sudan*, Cambridge University Press, Cambridge, 2008.

² Federal Ministry of Health, *Mapping of PHC Services in Sudan*, 2010.

rural areas have contributed to displacement and increased urbanisation.

The average household size is 6 persons, and the total fertility rate is 5.7 per woman. Almost half (45 per cent) of the population is under 15 years old, including 16.4 per cent under 5 years old. Over 50 per cent are in the age group 15 to 64 years and 3.9 per cent are 65 or more years old³. The average life expectancy at birth is 59 years (58 years for males and 61 years for females). About 89 out of every 1,000 children born alive do not live to celebrate their fifth birthday⁴.

1.3 Conflicts

Sudan has a long history of conflicts and crises that continues to this day. As the country started to recover from the long war with the South, new internal conflicts started in Darfur, Blue Nile and Nuba Mountains. These new conflicts have aggravated the situation in the country and contributed negatively to the problem of displacement. While the secession of the South initially brought relative peace to the border areas, conflict in the border states of Blue Nile and South Kordofan re-erupted in 2011 and continues to cause displacement, destruction and death. The conflict in Darfur reached a peak in 2004. However, a subsequent wave of violence across Darfur during 2013 and 2014 has caused an estimated 320,383 new displacements to date; of these, 188,760 persons remain displaced⁵. This is in addition to the 2 million people who have faced longer-term displacement since 2003–2005. In addition, at the end of 2013 a civil war broke out in South Sudan causing refugees to move to Sudan and the surrounding countries. These crises have continued to cause multiple shocks both socially and economically.

1.4 Economy

Sudan occupies the 171st place in the 2013 Human Development Index, indicating that the country still has one of the lowest levels of human development in the world⁶. Poverty remains widespread with 46.5 per cent⁷ of the population living below the poverty line, according to the

national definition of poverty (less than SDG3.8/person/day). Those who are most affected by poverty are the rural dwellers, particularly women and internally displaced persons.

Despite sanctions, in 2010 Sudan was rated as the 17th fastest growing economy in the world. This rapid development of the country resulted largely from oil profits⁸. With the secession of the South in July 2011, the new government took with it 75 per cent of the oil output. This has significantly affected government revenues as oil contributed about 30 per cent of the national budget. Undoubtedly, this will affect the near future economic forecast and the resources available for social services including health. Agriculture remains important as it employs 80 per cent of the workforce and contributes to one-third of GDP.



³ Central Bureau of Statistics, *Sudan Population Census*, Khartoum, 2008.

⁴ Ibid.

⁵ OCHA, update report, <<http://reliefweb.int/report/sudan/darfur-new-humanitarian-needs-and-aid-delivery-fact-sheet-29-april-2014>>.

⁶ The 2013 Human Development Report, *The Rise of the South: Human Progress in a Diverse World*, Human Development Report Office, UNDP, New York, NY, pp. 144-147.

⁷ UNDP, Explanatory note on the 2014 Human Development Report composite indices, hdr.undp.org/sites/all/themes/hdr_theme/country-notes/SDN.pdf.

⁸ World Bank and Ministry of Finance data, 2010.

2. Investment Case: The Problem and How it Can Be Addressed



2.1 Why an Investment Case?

No nation can afford to waste its greatest national resource – the intellectual power of its people. But that is precisely what is happening in Sudan where low birth weight is common, where children fail to achieve their full potential growth, where micronutrient deficiencies permanently damage the brain and where anaemia and short-term hunger limit children's performance at school. Globally, people are healthier, wealthier and live longer today than they did in 1990, the year of the Millennium Development Goals' (MDGs') baseline. Progress has, however, been unequal, and Sudan's burden of malnutrition is disproportionate to its population size. Although some improvement in health outcomes has been achieved, progress in investing in nutrition in Sudan is still very limited. Many factors contribute to the lack of progress – political instability, natural disasters, protracted conflicts, underdeveloped infrastructure, health system

weaknesses and lack of harmonisation and alignment of aid.

Investing in nutrition in Sudan provides an opportunity to accelerate economic development and growth, contribute to saving children's lives and prevent disabilities. The investment case for nutrition is designed to enhance the implementation of the National Nutrition Strategic Plan 2014–2018⁹. The goal of the Plan is to improve people's nutritional status throughout their lives by encouraging Sudan to make nutrition central to its development agenda. The Plan encourages the country to establish and implement nutrition interventions according to the local situation and resources. In this way it will protect and promote healthy child and maternal nutrition and prevent acute, chronic and micronutrient malnutrition. Purposeful, stepped up, targeted and coordinated interventions are needed to prevent the deaths of a large number of people,

⁹ Federal Ministry of Health Department of Nutrition, *National Nutrition Strategic Plan 2014-2018*, 2014.

to achieve MDG 1 and make a contribution to achieving MDGs 2, 3, 4, 5 and 6. Not only will the Plan help save the lives of mothers and their children, but it also makes the case for an *investment* that will yield measurable financial and economic returns to the government, the health sector, employers and individuals.

An *investment* package involving scaled up expenditure is required because a lack of money and finance sits at the heart of many of the poor nutritional outcomes. That is particularly so in Sudan because:

- Undernutrition is one of the country's most serious, but least addressed, socioeconomic and health problems. People's health suffers from:

- A lack of awareness of the consequences of and solutions to undernutrition
- The weak commitment from political leaders
- Limited resources for public investment. In general, the government lacks the political commitment and operational and financial capacity to develop and implement a comprehensive nutrition policy.

- Expenditure in the nutrition and health sectors is often too low to get results. This underfunding is the cause of several of the major bottlenecks found in Sudan. It is worth noting that only 40 per cent of the population is covered by the National Health Insurance System. Despite treatment for children under five and pregnant women being free of charge, less than 2 per cent of the population receive free care and 92 per cent pay for medicines¹⁰.

- Official Development Assistance (ODA) for nutrition is low. Most of the donor funding for nutrition in Sudan is to support humanitarian nutrition. Since the funds are meant for emergency response, they are short-term and unpredictable. In addition, some of the donor funds are earmarked for lifesaving interventions, such as the management of acute malnutrition, and will not support high impact interventions, such as promoting optimal strategies for feeding infants and young children.

- The Hunger and Nutrition Commitment Index¹¹, launched in April 2013, measures the political commitment to tackle hunger and undernutrition in 45 developing countries, including Sudan. This index compares and ranks countries for government inputs and outputs, and then assesses these within the context of their wealth, administrative capacity and prevalence of hunger and undernutrition. The results show that Sudan is languishing at the bottom of the league table, being ranked 45th out of 45 countries and being classified as having a very low commitment.

2.2 What Is the Scale of Undernutrition in Sudan?

The nutrition situation in Sudan is characterised by persistently high levels of acute malnutrition and stunting. Both trends have continued since record keeping began in 1987. In absolute terms, the nutrition situation of children is worsening and underscores the urgent need for policy and programme action for the prevention and treatment of child malnutrition. The rising prevalence of malnutrition and population growth explain why the absolute numbers of wasted, stunted and underweight children under five years of age have risen significantly. Today, there are more wasted and stunted children in Sudan than there were 20 years ago.

Table 1 shows the proportions of stunted, wasted and underweight children in Sudan and the WHO classification of the public health significance.



¹⁰ Federal Ministry of Health, *Review of Free Care for Mothers and Children in Sudan*, 2010.

¹¹ te Lintelo D, et al., *The Hunger and Nutrition Commitment Index (HANC 2012): Measuring the Political Commitment to Reduce Hunger and Undernutrition in Developing Countries*, Institute of Developing Studies, UK, 2013.

Table 1. Public health significance of child undernutrition in Sudan¹²

Form of undernutrition	Proportion (%)			
	Low	Medium	High	Very high
<i>WHO classification</i>				
Stunting	< 20	20–29	30–39	≥ 40
Wasting	< 5	5–9	10–14	≥ 15
Underweight	< 10	10–19	20–29	≥ 30
<i>Sudan (2010)¹³</i>				
Stunting			35	16.5
Wasting				32

Stunting is widespread and occurs frequently

Stunting is a reduced growth rate in human development. It reflects the failure to reach linear growth potential as a result of long-term undernutrition or illness, or a combination of both. In Sudan, 2.2 million children less than five years of age are stunted – just over one in every three children. It is no wonder that Sudan is one of the 14 countries where 80 per cent of the world's stunted children live¹⁴. A stunted child faces a higher risk of dying from infectious disease (1.9 to 6.5 times more likely to die) and the child is likely to perform less well in school (equivalent to two to three years' loss of education). Stunting is associated with impaired brain development, meaning lasting, impaired mental functioning. This, in turn, leads to significantly reduced learning. Adults stunted as children earn a lower income in life (on average, 22 per cent less), which further exacerbates deprivation. For a country as a whole, stunting may result in a loss to GDP of 2 to 3 per cent per year.

Acute malnutrition levels in Sudan are among the highest in the world

Sudan has a huge burden of acute malnutrition according to the WHO threshold for assessing severity of undernutrition. The national prevalence rate places Sudan in the 'critical' category with a global acute malnutrition level of 16.5 per cent. About one out of every six children weighs too little for her/his height. Four states have acute malnutrition levels above the WHO threshold for a critical situation and can be characterised as being **in crisis** (Figure 4).

These are North Darfur (28 per cent), Red Sea (20 per cent), Blue Nile (19 per cent) and South Darfur (18 per cent). Figure 4 also shows that acute malnutrition is a widespread public health problem affecting every state. These levels are far worse than those in the Horn of Africa. For example, in Somalia the prevalence of acute malnutrition is 14 per cent¹⁵. It is important to note that the majority (52 per cent) of the acutely malnourished children live in nine non-conflict affected states (Red Sea, Kassala, Gezira, Khartoum, Northern, River Nile, Gedaref, Sennar and White Nile).



¹² World Health Organization, *Physical Status: The Use and Interpretation of Anthropometry*, WHO, Geneva, 1995.

¹³ Central Bureau of Statistics, *Sudan Household Health Survey – Round 2 2010, 2012*.

¹⁴ UNICEF, *Improving Child Nutrition: The achievable imperative for global progress*, New York, NY, 2013.

¹⁵ FSNAU/FAO, et al., *Micronutrient and Anthropometric Nutrition Survey: Somalia*, 2009.

Figure 1. Prevalence of stunting by state

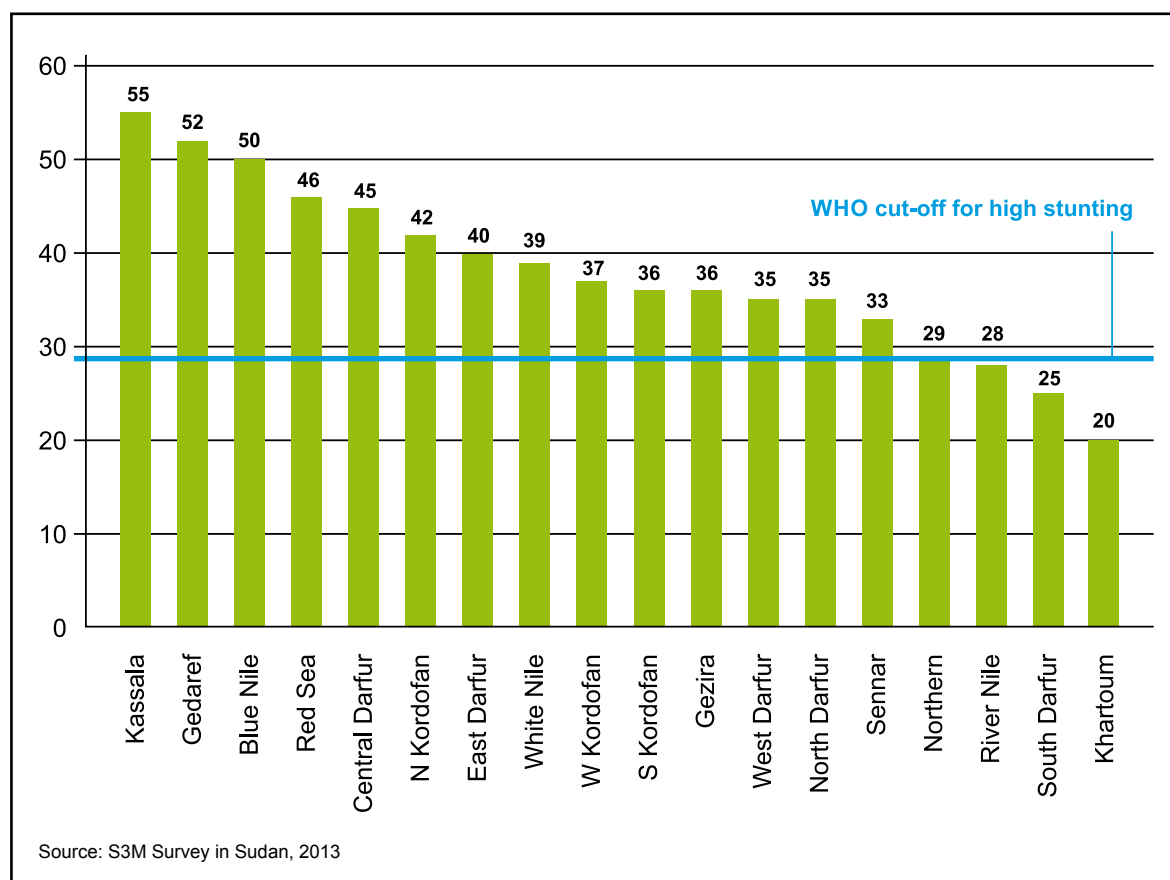
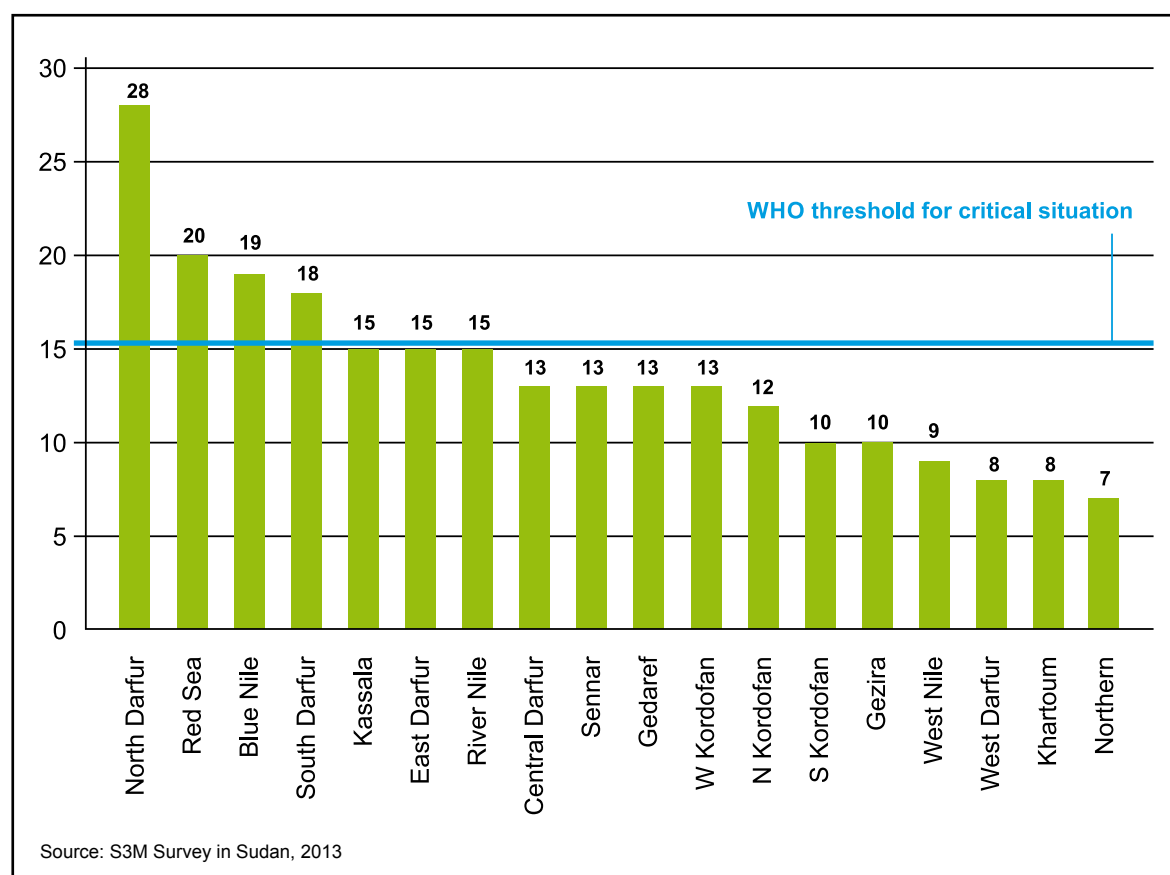


Figure 2. Prevalence of wasting by state



So far, the response to acute malnutrition has been insufficient

For example, in 2013, of 555,203 severely acutely malnourished children, just 122,919 received treatment. Thus 432,284 (78 per cent) of the children in need were not treated.

Micronutrient deficiencies – the hidden hunger

Deficiencies in vitamin A, iodine and iron are thought to be widespread. There has not been a micronutrient survey carried out since the 1990s. Proxy indicators from the 2012 simple spatial survey method (S3M) national nutrition survey, include:

- Low coverage with iron and folic acid supplements during the second and third trimesters of pregnancy
- Low postpartum coverage with vitamin A supplements
- Very high prevalence of night blindness during the last pregnancy suggest that the maternal micronutrient status is poor.

Night blindness – caused by vitamin A deficiency – during the last pregnancy was reported by up to 90 per cent of mothers in one locality in South Darfur¹⁶. In only 29 of 184 localities did less than 5 per cent of mothers experience night blindness during their last pregnancy. The WHO cut-off values classify a prevalence of ≥ 5 per cent as severe¹⁷.

Anaemia in children is associated with reduced cognitive development (as much as 9 IQ points may be lost), lack of concentration and listlessness. Studies in some African countries demonstrate that anaemia is most prevalent in the first 2 years of life. This is particularly worrisome as this is the age during which brain development takes place. In women of reproductive age, anaemia is a major cause of maternal mortality. WHO recently estimated the rates of anaemia in Sudan to be extraordinarily high – in preschool-aged children (88 per cent), pregnant women (58 per cent) and non-pregnant women (43 per cent)¹⁸. Also the contribution of micronutrient deficiencies to the disease burden is likely to be substantial.

Iodine deficiency is the leading preventable cause of brain damage worldwide and it can significantly lower the IQ of whole populations by 10 to 15 points. The most severe effects of iodine deficiency occur during foetal development and in the first few years of life. The SHHS 2010 showed that only 9.5 per cent of households consumed iodized salt²⁰, which meant that **over 1 million infants remained unprotected from iodine deficiency disorders**.

Table 2. Prevalence of anaemia among preschool-aged children and pregnant women and the WHO categories of public health significance

	Category of public health significance			
	No public health problem	Mild public health problem	Moderate public health problem	Severe public health problem
<i>WHO classification¹⁹</i>				
Prevalence of anaemia	≤ 4.9	5.0–19.9	20–39.9	≥ 40
<i>Prevalence of anaemia in Sudan</i>				
Preschool-aged children				88
Pregnant women				58
Non-pregnant women				43

¹⁶ Federal Ministry of Health/UNICEF, *S3M Survey Report*, 2014.
¹⁷ WHO, *Global Prevalence of Vitamin A Deficiency in Populations at Risk 1995–2005*. WHO Global Database on Vitamin A Deficiency, WHO, Geneva, p. 8 Table 4, 2009.
¹⁸ Worldwide Prevalence of Anaemia 1991–2005, *Global Database on Anaemia*, with additional data from Demographic and Health Surveys and WHO global database on Anaemia.
¹⁹ WHO, *Worldwide Prevalence of Anaemia 1993–2005*, in *WHO Global Database on Anaemia*, edited by B. de Benoist, E. McLean, I. Egli and M. Cogswell, WHO, Geneva, 2008.
²⁰ Central Bureau of Statistics, *SHHS – Round 2, 2010, 2012*.

3. Some Key Contributing Factors to High Malnutrition Rates in Sudan



3.1 Sub-Optimum Infant and Young Child Feeding Practices

Improving infant and young child feeding (IYCF) practices, especially exclusive breastfeeding and complementary feeding, has been identified as the single most important intervention in a package of essential child survival interventions recommended for low-income countries with high levels of child undernutrition and mortality rates. Promoting breastfeeding and complementary feeding are, therefore, integral interventions for child survival; they have the potential to substantially reduce child mortality²¹.

Figure 3 shows that exclusive breastfeeding and the timely introduction of age-appropriate, quality complementary foods lag behind early

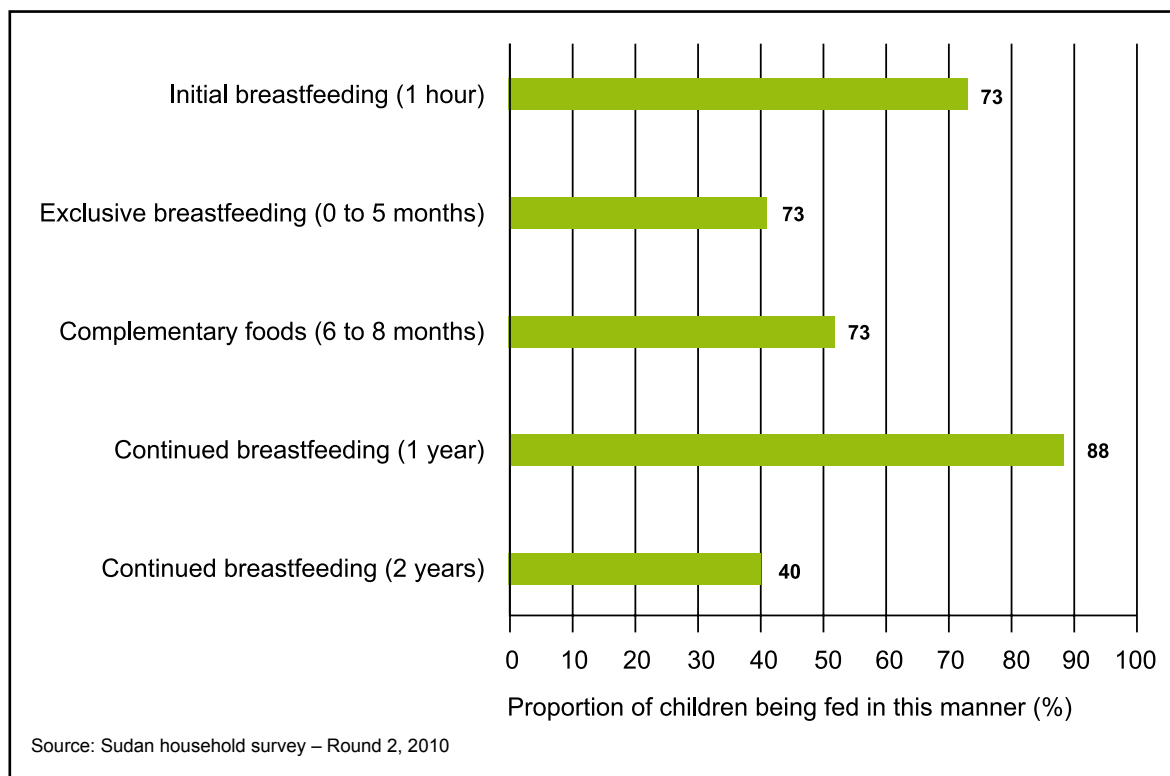
initiation and continued breastfeeding up to one year of age. The low exclusive breastfeeding and complementary feeding levels reflect sub-optimal infant feeding practices which are a major cause of undernutrition among young children. This, in part, explains the very high acute malnutrition and stunting levels in children under two years old.

In 2011, a causal analysis of severe acute malnutrition (SAM) in Kassala state found that early (before the age of 6 months) introduction of fluids other than breast milk was associated with the risk of SAM; not introducing other fluids was found to be protective against SAM²² (odds ratio = 0.7). Early introduction of other fluids is a marker of poor IYCF practices.

²¹ *The Lancet 2003 Child Survival Series* estimates that with 90 per cent coverage of exclusive breastfeeding for the first six months and 90 per cent coverage of continued breastfeeding to 12 months, child mortality could be reduced by 13 per cent. It also estimates that timely and appropriate complementary feeding could avert 6 per cent of the under-five deaths. *The Lancet 2008 Nutrition Series* estimates that optimal breastfeeding practices up to 2 years could potentially save 1.4 million lives annually.

²² Federal Ministry of Health/State Ministry of Health/UNICEF/GOAL, *Report on Rural Kassala CMAM program coverage survey and training using SQUEAC tools and SAM causal analysis*, 2011.

Figure 3. Exclusive breastfeeding and good infant and young child feeding practices



3.2 Water and Sanitation Needs Are Great

Unsafe drinking water and poor hygiene frequently lead to increases in diarrhoeal diseases, often rendering the use of nutritional supplements and other nutrition efforts ineffective. In Sudan, 20 per cent of the population uses unimproved water sources²³. In addition, national nutrition survey results in 2013 showed that almost half the children surveyed had had an episode of diarrhoeal disease in the two weeks preceding the survey.

Open defecation, improper sanitation facilities and waste disposal often contaminate food production. Provision of improved sanitation facilities is low across the country. In Khartoum State less than 50 per cent of people use improved sanitation facilities. This is compounded by the non-sanitary **disposal of children’s faeces**. Good **hand washing practices** are poor with only four of the 18 states having a mean above 2.5 for the five critical hand washing times.

In Sudan, there is a recognised association between increased access to improved sanitation facilities and water sources and the reduction of stunting levels in children. There is a general reducing trend in the stunting rate associated with the population’s increased access to improved water (see Figure 9).

The child stunting rate also increases with an increased rate of open defecation (see Figure 10)²⁴.



²³ Central Bureau of Statistics, *Sudan Household Health Survey – Round 2, 2010*, National Report, 2012.

²⁴ *Ibid.*

Figure 4. Improved water and stunting prevalence

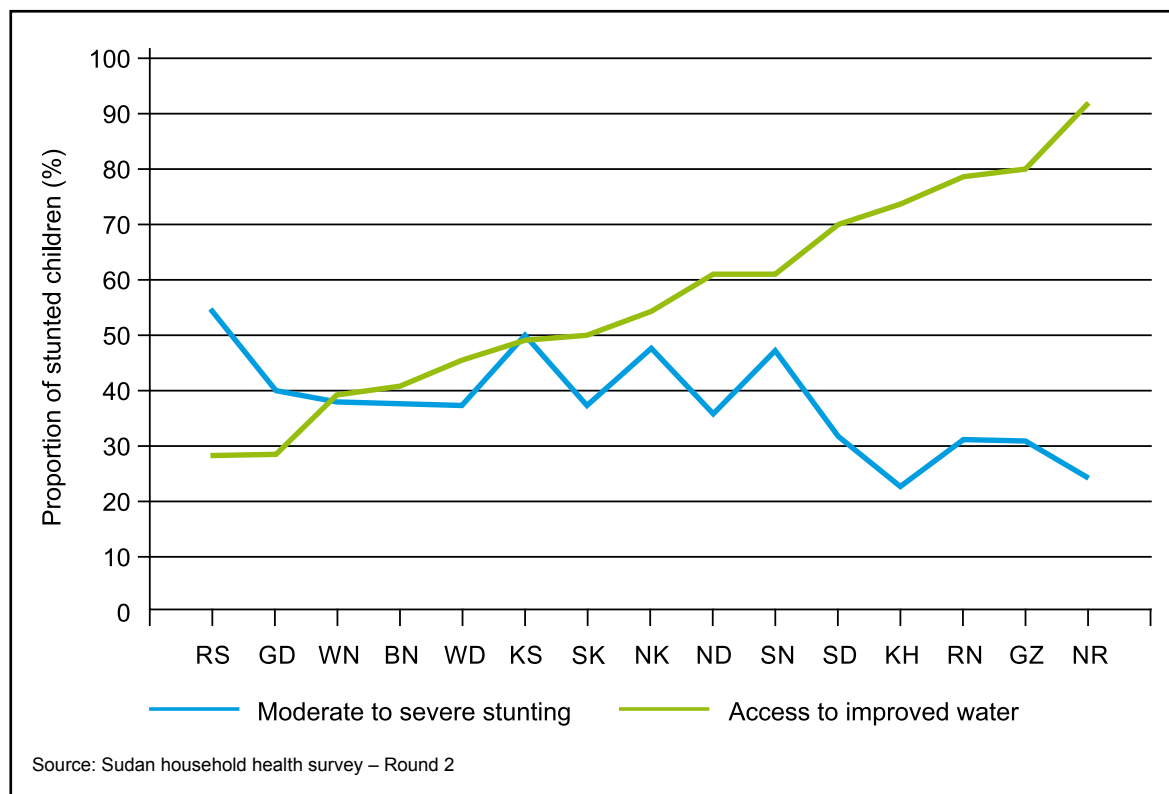
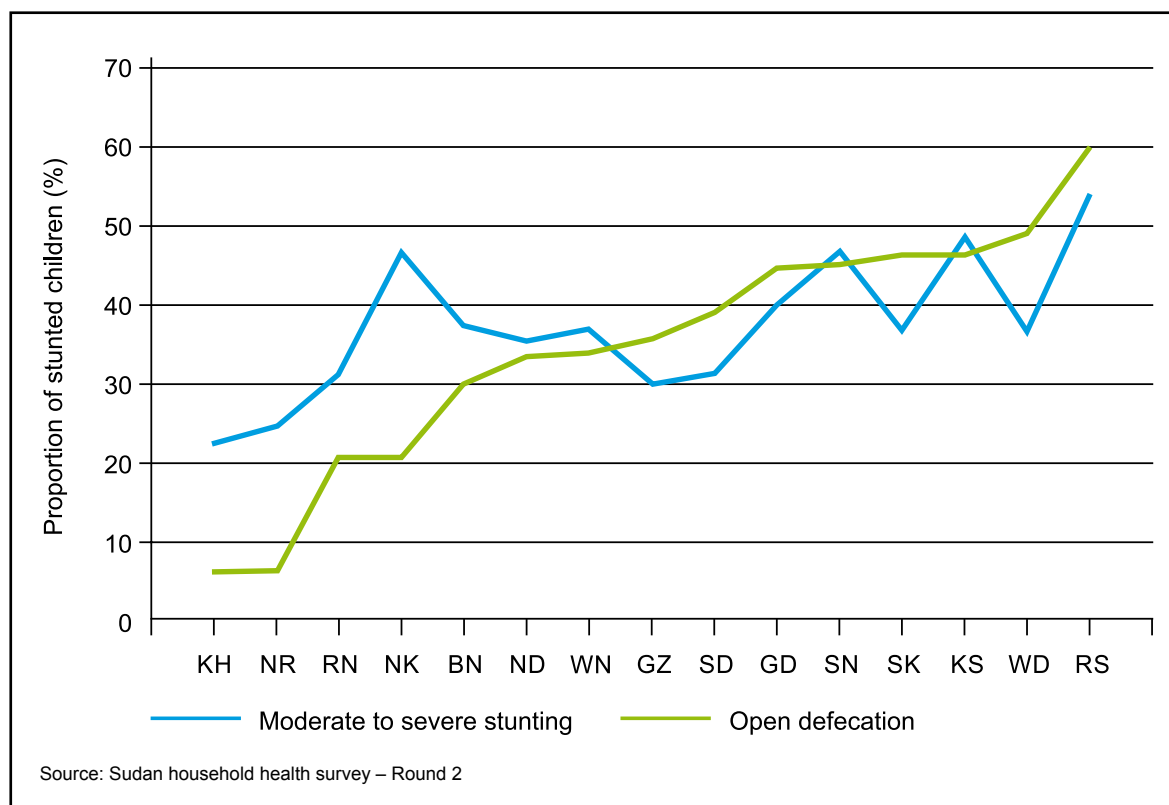


Figure 5. Open defecation status and stunting prevalence by state



Food insecurity is widespread

Household food insecurity is one of the primary underlying causes of malnutrition in Sudan. One out of three Sudanese suffers food deprivation and over 46 per cent are classified as poor. In 2014, the number of food insecure persons went from 4.2 million in July to 5.7 million in August. Inadequate food intake and poor dietary diversity in many households are linked to the high prices of food and basic commodities, poor harvests and limited knowledge of nutrition. Food prices are at an all-time high – estimated at 150 per cent higher than the average of the last five years. Additionally, Sudan is the fifth most food insecure country in the world – ranking 74th out of 78 countries in the 2013 Global Hunger Index.

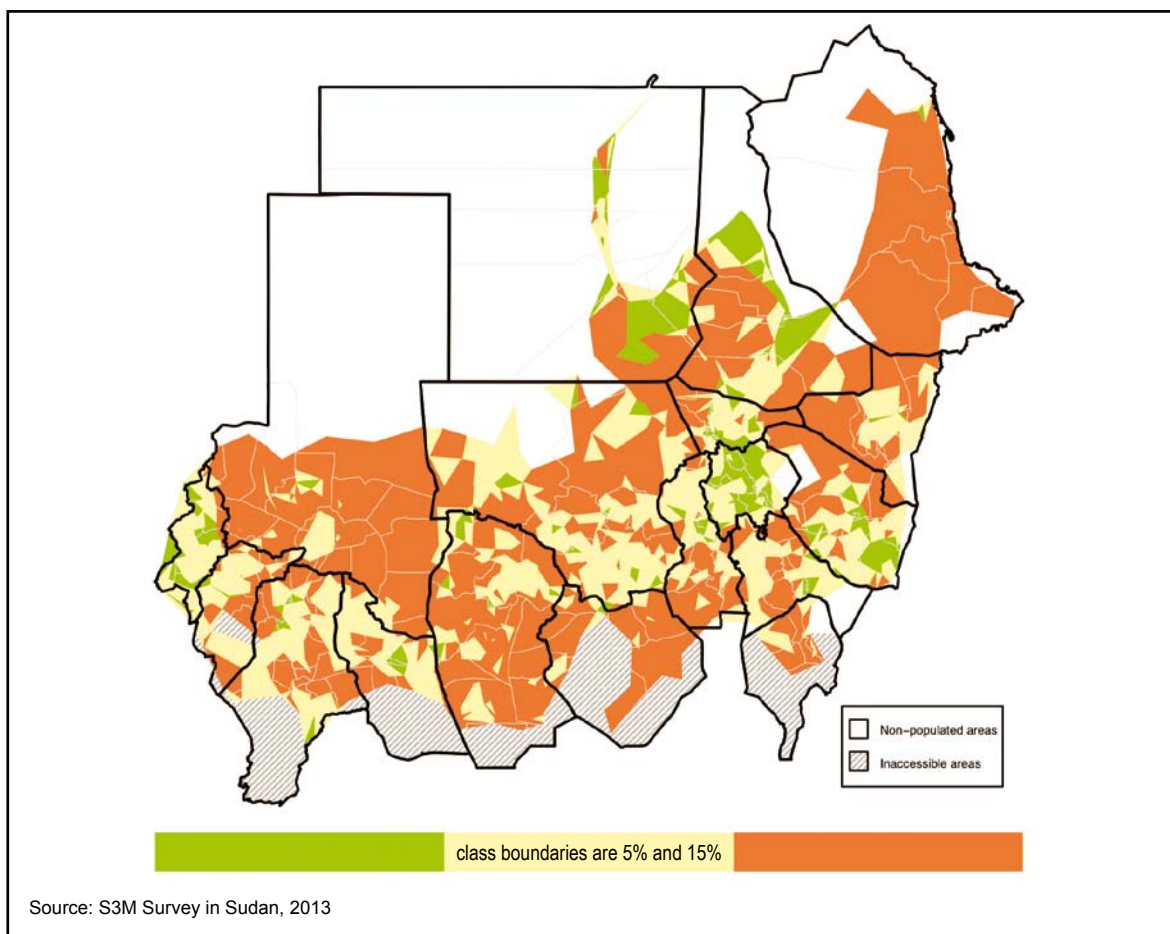
Maternal nutrition – the missing link

The high levels of maternal undernutrition across the country are contributing to the high levels of child stunting. The nutritional status

of the mother has intergenerational effects, not only affecting her pregnancy and birth outcomes, but also the growth and development of her child. Micronutrient deficiencies during the critical window of opportunity – the first 1,000 days, starting from pregnancy through to a child’s second birthday – can have long-lasting implications for the growth and development of a child.

Figure 6 shows the distribution of maternal undernutrition. The highest level of maternal undernutrition is in Red Sea State, where one in every three mothers is malnourished. This is followed by North Darfur (26 per cent). In Haia locality (Red Sea State) up to 62 per cent of mothers are undernourished. A prevalence of maternal undernutrition greater than 50 per cent is classified as ‘extreme’²⁵. Yet, interventions to improve maternal nutrition are not to be seen in Sudan.

Figure 6. Prevalence of maternal undernutrition (as measured by mid-upper arm circumference less than 230 mm) by state



²⁵ Mid-upper arm circumference < 23 cm, > 50 per cent classified as extreme, Food Security Nutrition Assessment Unit – Somalia, <<http://www.fsnao.org>>.

The uptake of antenatal care (ANC) services is correspondingly low. At the state level, only three states reported four or more ANC visits to more than 50 per cent of pregnant women. The lowest coverage reported was in two localities in Red Sea State (with 0 and 2 per cent coverage)²⁶.

Furthermore, 10 per cent of Sudanese girls are married before reaching the age of 15, and 38 per cent are married before the age of 18²⁷, which has detrimental consequences for health and nutrition. Maximum adult height can be reached as early as 16 years or – particularly for populations such as Sudan with high rates of undernutrition – as late as 23 years²⁸. Thus

undernourished adolescent girls may not have finished growing before their first pregnancy, predisposing them to deliver low birth weight (LBW) babies. In Sudan, the prevalence of LBW babies is 31 per cent²⁹. This is probably a result of the competition for nutrients between the growing adolescent and the growing foetus. This results in poorer placental function, which in turn increases the risk of LBW babies and neonatal mortality. The calcium status of mothers is of particular concern as the bones of adolescents still require calcium for growth at a time when foetal needs for bone growth are also high³⁰.



²⁶ Federal Ministry of Health/UNICEF, *S3M Survey Report*, 2014.

²⁷ Central Bureau of Statistics, *SHHS – Round 2, 2010, 2012*.

²⁸ Roche, A.F., et al., 'Late adolescent growth in stature', *Paediatrics*, 50, pp. 874–880, 1972.

²⁹ UNICEF, *State of the World's Children*, New York, NY, 2009.

³⁰ Allen, L. and Gillespie, S., *What works? A review of the efficacy and effectiveness of nutrition interventions*. ACC/SCN Nutrition Policy Paper no. 19 and ADB Nutrition and Development Series no. 5, Manila: ADB in collaboration with ACC/SCN, 2001.

4. Why Invest in Nutrition in Sudan?



4.1 Investing in Nutrition Will Produce Real Benefits in Economic Growth

Good nutrition outcomes have been associated with accelerated national economic growth rates and are considered essential for achieving the majority of the MDGs. Undernutrition has high economic and welfare costs, which fall roughly into four categories. Inadequate nutrition:

- Increases child and maternal mortality
- Increases susceptibility to disease
- Reduces school performance
- Lowers human capital development and labour productivity.

In short, undernutrition undermines all aspects of development. Delaying the investment to improve the nutrition status of the population imposes real financial costs on individuals, households, the health system and the next generation. What is at the core of the challenges of undernutrition in Sudan are the countless lives that can be

saved and improved, the suffering that can be alleviated and the human potential that can be realised.

In Asia, there have been good examples of how improvements in nutrition contributed to economic growth through enhanced human capital development. In the early 1980s Thailand implemented a nationwide community-based nutrition programme. As a result, Thailand reduced child undernutrition by half – from 50 per cent to 25 per cent – in less than a decade (1982 to 1986). Needless to say, Thailand is now an upper middle income country. China reduced child undernutrition by more than half – from 25 per cent to 8 per cent (1990 to 2002). Not surprisingly, China became a middle income country in 2009. Vietnam implemented an integrated community nutrition programme and reduced child undernutrition by 40 per cent – from 45 per cent to 27 per cent (1990 to 2006). Vietnam became a middle income country in 2010.

Table 3: Prevalence of common nutritional disorders in Sudan and associated loss in IQ

Indicator	Prevalence (%)	IQ loss (points)
Iron deficiency anaemia (< 5 years old)	85	9
Sub-optimal breastfeeding in first 6 months	59	4
Stunting (< 5 years old)	35	5 to 10
Low birth weight	31	5
Iodine deficiency disorders	22	10 to 15

Improved nutrition will reduce high maternal, infant and child mortality

Although there is no Sudan-specific data on child mortality attributable to undernutrition, globally it is estimated that 45 per cent of child deaths are due to undernutrition, mostly from increased severity of disease. It is conceivable that the proportion is higher in Sudan. Given the alarming levels of malnutrition, underweight babies are almost four times more likely to die during the first month of life than are babies of normal weight. For those who survive, 20 per cent of them are more likely to be stunted at 12 months of age. A child who is severely acutely malnourished is 11.6 times more likely to die than a well-nourished one. Malnutrition also affects maternal mortality. Iron deficiency anaemia is associated with 22 per cent of maternal deaths and 24 per cent of neonatal deaths. In Sudan, 58 per cent of pregnant women are anaemic.

Undernutrition decreases educational performance

In Egypt and Ethiopia, Cost of Hunger in Africa (COHA) showed that stunted children's achievements are 1.2 schooling years lower than those of well-nourished ones. In Ethiopia, it was estimated that the repetition rate in primary school among stunted children was 15 per cent, while among non-stunted children it was 11 per cent³¹.

As shown in Table 3, nutrition disorders can permanently lower IQ by up to 15 points.

Sudan is not on track to achieve MDG 1

Figure 7 shows that underweight and stunting levels in Sudan progressively increased between 1990 (when the MDGs were introduced)

and 2000. Although there was a significant reduction in the two indicators of undernutrition (underweight and stunting) between 2000 and 2006, the trend has stagnated. MDG 1 focuses specifically on reducing hunger, measured using the proxy indicator of underweight.

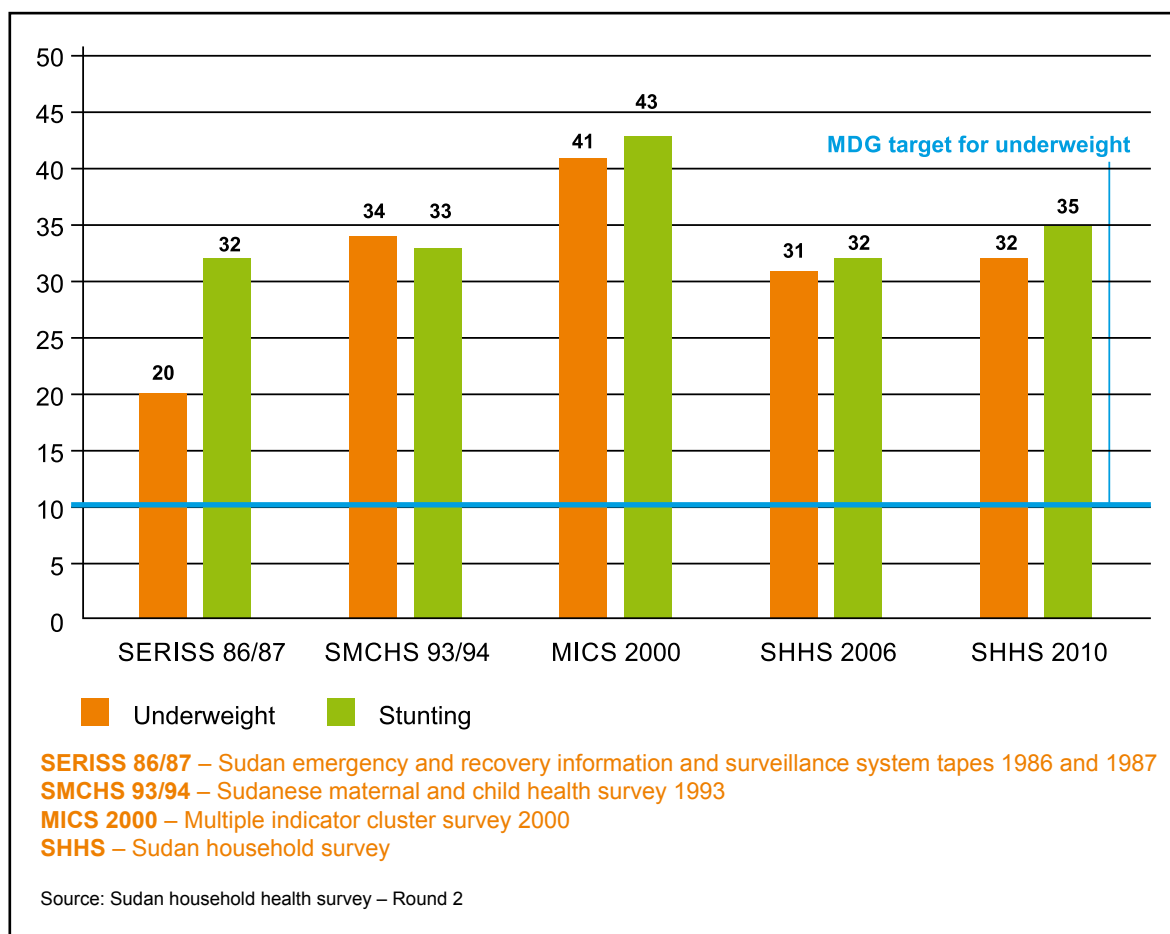
MDG 1 is linked through cause and effect to five other MDGs. Achievement of MDG 1 will improve school performance (MDG 2), improve maternal nutrition (MDG 3), reduce child mortality (MDG 4), improve maternal health (MDG 5) and reduce the burden of disease (MDG 6). Investing in children's nutrition results in healthier, better educated and more productive adults with important gains to individuals and the economy, which would improve the income poverty aspect of MDG 1. **Improving the nutrition of Sudanese children will reduce inequity, lessening the risk of social and political instability.**

Undernutrition decreases labour productivity

Undernutrition robs people of their earning potential and stands in the way of a country's economic development. Undernutrition in the 1,000 days between pregnancy and a child's second birthday carries lifelong consequences. It affects a child's survival, growth and development, ability to learn and lifelong health and productivity. This is exacerbated by high levels of maternal undernutrition in the country. Investing in nutrition in Sudan provides an opportunity to accelerate economic development and growth, contribute to saving thousands of lives and preventing lifelong disabilities, and moves the country closer to achieving the objectives of the national poverty reduction strategies and the MDGs.

³¹ African Union Commission/NEPAD/UNECA/WFP, *The Cost of Hunger in Africa: Social and Economic Impact of Child Undernutrition in Egypt, Ethiopia, Swaziland and Uganda*, UNECA, Addis Ababa, 2014.

Figure 7. Sudan is not on track to achieve the MDG 1 target



Improved nutrition will reduce the financial costs of health care

Improved nutrition will reduce the financial costs of health care for the family, the community, the private sector and the government. There are several potential consequences for households related to the costs of health care. First, costs could be prohibitively expensive, which may mean that parents have to forego treatment for their children. Second, to pay for health care, households may have to sell their assets or incur debts. Third, health care costs can have a catastrophic impact and push households into, or more deeply into, poverty. These challenges are especially relevant in Sudan where the availability of risk pooling mechanisms, such as health insurance, is low. At the macro level, society as a whole would benefit from a healthy population. The costs to the government and the private sector for health care provision, lost productivity, high turnover and unemployment benefits would be reduced.

4.2 Does Sudan Have an Enabling Environment for Investing in Nutrition?

There is some support and commitment from the government to address the underlying and basic causes of undernutrition. In 2014, the government of Sudan released the S3M national nutrition survey results acknowledging the huge problem of malnutrition. Consequently, the government has worked with UNICEF to develop a national scale up plan to treat acute malnutrition. The National Nutrition Directorates, with support from UNICEF, World Food Programme (WFP) and partners, developed the four-year Multi-sector Strategy to Address Malnutrition 2014–2018.

In addition, the Federal Ministries of Health and Agriculture are currently developing a comprehensive food security and nutrition policy.

The establishment of a Food Security and Nutrition Council to oversee the implementation of the plan is under discussion. This presents an unprecedented opportunity to redouble efforts to prevent and treat undernutrition in Sudan.

A significant change in nutrition outcomes in Sudan requires high coverage with, and equitable use of, an integrated multi-sector package of interventions, which comprises both nutrition-specific and nutrition-sensitive interventions. These nutrition actions have been endorsed by the scaling up nutrition (SUN) movement and already form the basis of the overall strategy for nutrition of many development partners. Some of the interventions are being implemented in Sudan at this time, albeit on a limited scale and with limited resources that render them ineffective. The first phase of the investment case will be implemented in line with the government's National Nutrition Strategic Plan 2014–2018, the Sudan National Acceleration Plan for Maternal and Child Health 2013–2015 and the roll-out of the community-based management of acute malnutrition (CMAM) scale up plan.

4.3 Why Are UNICEF and WFP Joining Forces?

WFP and UNICEF work together at the global and national levels to address undernutrition. WFP is mandated to fight hunger in all its forms while UNICEF works towards the protection of children's rights – to help meet their basic needs and to expand their opportunities to reach their full potential. Food insecurity causes undernutrition, which in turn predominantly affects children. If undernutrition is not addressed, it is likely that these children will grow up to become less productive adults, turning the problem into an intergenerational cycle of hunger and undernutrition.

The collaboration between WFP and UNICEF in the nutrition sector is sanctioned at the global level through a Memorandum of Understanding (MoU) that defines their complementary roles and responsibilities. The two UN agencies have strong field presences and work complementarily. In Sudan, this collaboration was formalised in 2013 through a Letter of Understanding, which commits both organisations, together with World Health Organization (WHO), Food and Agriculture Organization of the United Nations (FAO), United Nations Population Fund and International Fund for Agricultural Development (IFAD), to join forces in fighting undernutrition,

one of the main impediments to a healthy and productive Sudan. The first initiative under the MoU is a three-year project to link resilience and nutrition in Kassala state. This is supported by UNICEF, WFP and FAO with funding from the United Kingdom's Department for International Development.

Together, WFP and UNICEF contribute over 75 per cent of the nutrition response in Sudan's Strategic Response Plan 2014. The overall financial needs stand at US\$81 million. This money is used mostly for the core pipeline of nutrition products required to prevent and treat acute malnutrition, capacity development and social and behaviour change interventions. The simple spatial surveying method (S3M) nutrition survey provides a solid foundation for a common understanding of the magnitude and geographic location of needs and where investment of resources can be targeted for maximum impact.

On that basis, UNICEF and WFP have collaborated with the Federal Ministry of Health to design a joint scaling up plan for the CMAM framework. CMAM is collaboratively supported in 9 out of 18 states; it is hoped to expand the framework to 13 states in the near future.

4.4 Proposed Investment to Scaling Up of Nutrition in Sudan

To reduce undernutrition, four scenarios for scaling up investment in nutrition in Sudan have been considered:

- Scenario 1: Business as usual (maintaining the status quo)
- Scenario 2: UNICEF/WFP initial scale up plan (starting in five states)
- Scenario 3: Medium coverage (50 per cent coverage nationwide)
- Scenario 4: High coverage (90 per cent coverage nationwide).

Within each scenario the level of target coverage, the geographic focus and technical support will be adjusted to suit the location.

In Scenario 1 the country maintains the baseline level of coverage throughout the period without scaling up interventions.

Scenario 2 is based on the coverage levels proposed in an integrated package of interventions by UNICEF and the WFP to scale up nutrition in Sudan. In this plan CMAM, home fortification

of food with micronutrients, iron-folate and vitamin A supplements, use of iodized salt and immunisation are implemented nationwide. The rest of the interventions are rolled out initially in five states (Red Sea, Gedaref, Gezira, Central Darfur and Kassala) to test what would work in the Sudanese context. Eventually they will cover all 18 states. The five states were selected not only on the basis of the magnitude of both acute malnutrition and stunting, but also on the level of some other indicators, such as health, water, sanitation and hygiene (WASH) and food insecurity.

Scenarios 3 and 4 are based on a general nationwide scaling up of the coverage of the package of interventions listed above. Scenario 3 looks at providing coverage up to 50 per cent (medium coverage) and Scenario 4 considers 90 per cent coverage (high coverage for the maximum effect on child undernutrition and mortality reduction).

Interventions

The interventions included in the four scenarios are a selection of highly effective direct nutrition actions and nutrition-sensitive interventions that can contribute significantly to large-scale reductions in undernutrition – as described elsewhere in this document. These nutrition interventions span a variety of sectors and address underlying and basic determinants of the nutrition outcomes.

4.5 What Will it Cost and What Returns Can Be Expected?

Costing methodology

A detailed costing exercise to establish the costs of implementing the activities necessary to support the scaling up of direct nutrition actions and nutrition-sensitive interventions was undertaken. The costing was performed applying the 'ingredients approach' based on the UN OneHealth tool (OHT) and using Scenario 2 (UNICEF/WFP initial scale up plan) as a base.

The ingredients approach embodies a bottom-up method of costing. We first isolated the activities defining each intervention and then identified,

quantified and costed all of the inputs needed to produce the target outputs. In addition to the direct costs per input (medical supplies, medical personnel costs, etc.), we estimated indirect programme costs (programme personnel, technical support, monitoring and evaluation, supervision, advocacy, etc.) and other shared health system costs, such as infrastructure and logistics. Input costs were calculated as follow:

- Direct input costs were obtained from the UNICEF International Drug Price Indicators database
- Direct medical personnel costs, including salaries for nurses, midwives and community health workers, were calculated in terms of the number of full-time equivalent personnel required for each intervention and service delivery channel (community, outreach, clinic/health centre and hospital)
- Indirect programme costs were obtained from the UNICEF and WFP estimated sector-specific programme costs required to scale up activities to the targets defined in Scenario 2
- Other shared health system costs were estimated to be a mark-up of 7 per cent on all other costs.

Estimation of costs

The additional cost of achieving 90 per cent national coverage for the full package of direct nutrition actions and nutrition-sensitive interventions would be **US\$443 million per year**. **This equates to a total cost of US\$524 million** given that the cost of maintaining the existing coverage level is estimated at approximately US\$81 million annually.

If the programme is scaled up to provide 50 per cent coverage nationally, the same package of interventions would cost Sudan an additional US\$255 million per year (total cost US\$336 million).

The UNICEF/WFP initial scale up plan (Scenario 2), with some interventions initially implemented in five states only, **would cost an additional US\$99 million per year** (total cost US\$180 million). **See Figure 8 for the total costs over five years.**

³² World Bank, *Scaling Up Nutrition. What Will It Cost?* International Bank for Reconstruction and Development/The World Bank, Washington, DC, 2010; Horton, S. and Steckel, R., Global economic losses attributable to malnutrition 1900–2000 and projections to 2050, in *The Economics of Human Challenges*, edited by B. Lomborg, Cambridge University Press, Cambridge, UK, 2013.

Table 4. Proposed nutrition, health, livelihood/food security and social protection interventions and their target recipients

Sector	Target population
<i>Nutrition</i>	
Daily iron and folic acid supplements	Pregnant women
Breastfeeding counselling and support	Postpartum and pregnant women
Complementary feeding counselling and support	Children 6–23 months
Micronutrient fortification of foods at home	Children 6–23 months
Vitamin A supplements	Children 6–59 months
Management of SAM	Children 6–59 months
Treatment of moderate acute malnutrition (MAM)	Children 6–59 and pregnant and lactating women
Food-based prevention of MAM	Children 6–23 and pregnant and lactating women
Iodized salt	Total population
<i>Health</i>	
Antenatal care (ANC)	Pregnant women
Postpartum care	Mothers and newborns
Tetanus toxoid	Pregnant women
De-worming	Pregnant women and children 12–59 months
Kangaroo care	Newborn
Oral rehydration therapy	Children 0–59 months
Zinc (diarrhoea treatment)	Children 0–59 months
Pneumonia treatment	Children 0–59 months
Malaria treatment	Children 0–59 months
Measles vaccine	9 months
Rotavirus	2 and 4 months
<i>WASH</i>	
Use of an improved water source	Households
Improved excreta disposal (improved latrines/toilets)	Households
Hand washing with soap	Households
Hygienic disposal of children's stools	Households
<i>Livelihood/food security</i>	
Labour intensive asset creation (food for assets)	Households
Nutrition value chain of food products	Households
Small business skills, literacy (food for training)	Households
<i>Social protection</i>	
Conditional cash transfer (CCT)	Pregnant and lactating women

Table 5. Projected cost per beneficiary and baseline coverage per intervention

Intervention	Cost per beneficiary (US\$)	Baseline coverage (%)	Initial geographic focus
<i>Prevention of undernutrition</i>			
De-worming (children)	0.05	0	
Pneumonia treatment (children)	3.21	69	5 States
Malaria treatment (children)	3.88	21	5 States
Measles vaccine	5.12	85	5 States
Rotavirus	6.72	0	
Complementary feeding counselling and support	17.40	37	5 States
Home fortification of food with micronutrients	6.94	7	Nationwide
Food-based prevention of MAM	83.20	7	Nationwide
Universal use of iodized salt	0.24	9	Nationwide
Use of improved water source	135.51	55	5 States
Improved excreta disposal (latrine/toilet)	57.90	30	5 States
Hand washing with soap	31.44	30	5 States
Hygienic disposal of children's stools	31.44	30	5 States
<i>Reduction of child mortality</i>			
Oral rehydration therapy	1.44	15	5 States
Kangaroo care	1.26	0	
Zinc (diarrhoea treatment)	2.19	15	5 States
Breastfeeding counselling and support	8.76	65	5 States
Vitamin A supplements	0.58	82	Nationwide
Management of SAM (children) – Inpatient	54.06	20	Nationwide
Management of SAM (children) – outpatient	101.29	20	Nationwide
Treatment of MAM	41.80	21	Nationwide
<i>Improvement of maternal nutrition</i>			
Pregnancy care – ANC	5.80	39	5 States
Tetanus toxoid	0.33	0	
Daily iron and folic acid supplements	2.80	33	Nationwide
Labour intensive asset creation and food for training	62.35	0	5 States
Conditional cash transfer	78.75	0	15 States

Two studies (World Bank, 2010; Horton and Steckel, 2013) estimated that investing in nutrition can increase a country's GDP by at least 3 per cent annually³². For Sudan, with a **2013 GDP³³ of US\$66.55 billion, this amounts to a gain of approximately US\$2 billion per year. This is significantly above the annual cost of the high coverage scenario presented in this investment case (US\$524 million).**

The high coverage Scenario 4, although the most expensive, gives the most cost-effective returns in terms of reducing undernutrition and mortality in Sudan, coupled with the highest number of lives saved and cases of stunting averted. Thus, efforts to address undernutrition in Sudan should be directed at achieving high national coverage, which is the most cost-effective way of SUN for both child mortality reduction and prevention of stunting.

When these costs are broken down by intervention package (Table 6), prevention of undernutrition is the most expensive package across the four scenarios. The investment in improving the maternal nutrition package interventions also increases significantly from Scenario 1 to Scenario 4, relative to the other packages. This cost surges from US\$12 million to US\$532 million over the five years of the plan. This package is the least developed component at the moment and contains a majority of the interventions currently not implemented in

Sudan, including livelihood, food security and social protection interventions. The estimated total investment over the five years of the plan for the prevention of undernutrition is US\$1,473 million for Scenario 4. It is important to note that the cost of this package is relatively high because stunting reduction requires substantial cross-sector coordination and investment with the WASH and health sectors.

A detailed list of costs by intervention and scale up scenario is contained in Appendix 1.

The cost of each package over the five years is shown in Figure 8.

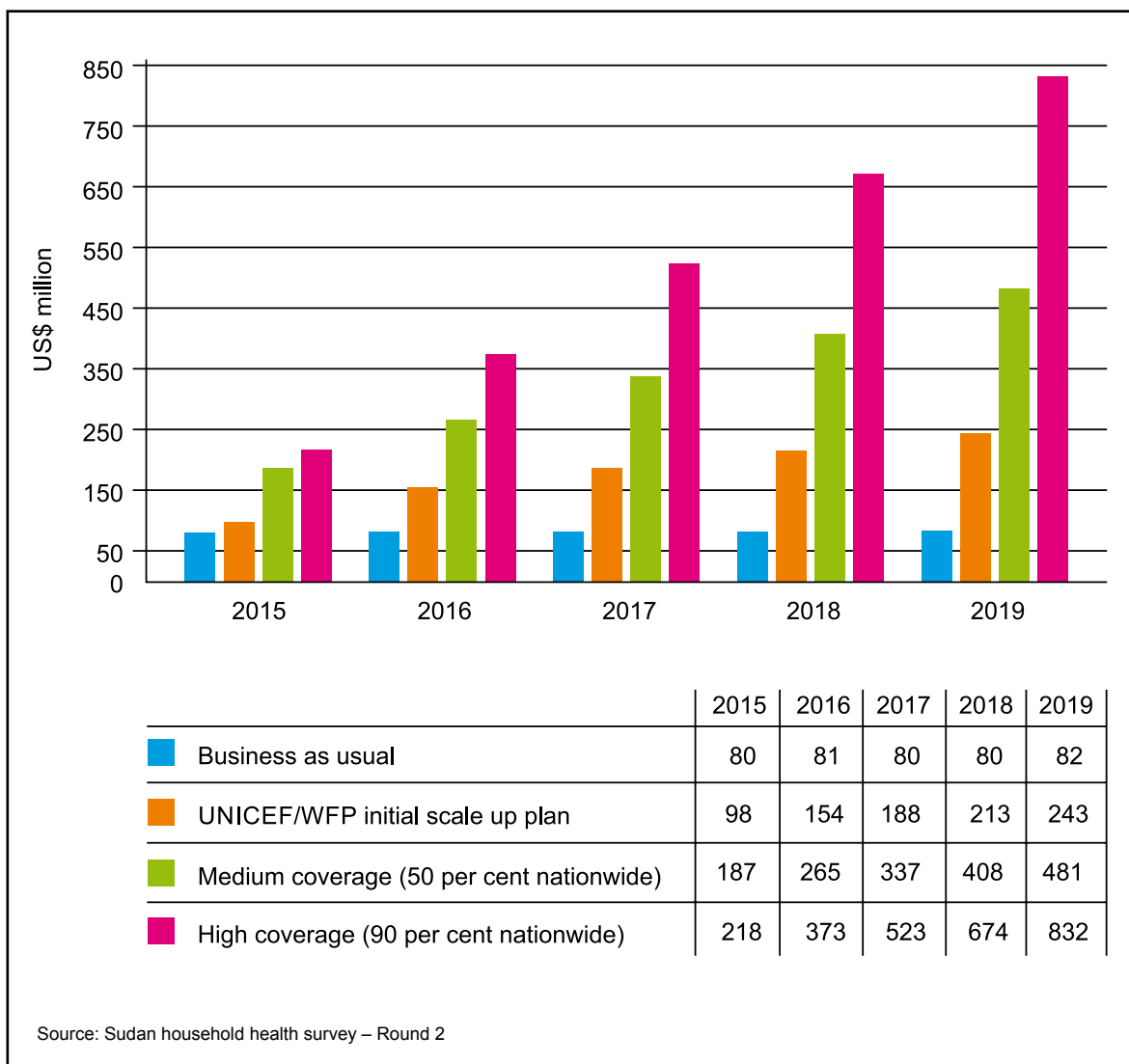


Table 6. Estimates of cost by scenario 2015–2019 (US\$ million)

Scenario	Prevent undernutrition	Reduce child mortality	Improve maternal nutrition	Total cost	Annual average cost	Annual incremental cost
1. Business as usual	219	172	12	403	81	
2. UNICEF/WFP initial scale up plan	389	313	195	897	179	99
3. Medium coverage (50 per cent nationwide)	923	406	349	1,678	336	255
4. High coverage (90 per cent nationwide)	1,473	615	532	2,620	524	443

³³ <<http://data.worldbank.org/country/Sudan>>.

Figure 8. Projected cost estimates by scenario over five years (US\$ million)



5. Results and Impact Analysis



An analysis of the impact of the four nutrition intervention scenarios on the prevalence of stunting, wasting, under-five mortality rate, exclusive breastfeeding prevalence and anaemia in pregnant women in Sudan was undertaken.

The scale of the benefits estimated in this model have to be considered as highly conservative as they do not account for some of those nutrition-sensitive interventions that currently are not included in the model used in this impact analysis (LiST).

5.1 Methodology

To analyse the results of investing in nutrition in Sudan, four different scaling up scenarios were developed with the OHT using the LiST model. We assessed the effects of the different scenarios on under-five mortality, stunting, wasting, anaemia in pregnant women and exclusive breastfeeding rates.

To calculate the **cost-effectiveness** of the four scenarios we looked at the number of deaths prevented in children under five years of age (lives

saved) and the number of cases of stunting averted in children 6–59 months of age³⁴. These projected indicators were also obtained using LiST. To calculate the cost-effectiveness ratios we combined this information with the costs per package of interventions.

5.2. Overview of the Lives Saved Tool (LiST)

LiST is a computerised module integrated within the OHT and used to estimate the effects of nutrition-specific and nutrition-sensitive interventions on undernutrition and child mortality. LiST is based on a linear mathematical model linking the coverage of interventions to outputs, such as level of risk factors (like stunting and wasting) or cause-specific mortality (child mortality 1–59 months). The relationship between the changes in the intervention coverage with one or more outputs is specified in terms of the effectiveness of the interventions in reducing the probability of that outcome. The coefficients of effectiveness per intervention and the demographic data are already populated in LiST from a Sudan-specific

³⁴ The number of cases of stunting averted is the difference between the estimated stunting prevalence in the target year with the prevalence in the base year. This percentage change is then multiplied by the total population of children 6–59 months of age.

database. Baseline data for each intervention and prevalence were taken from the 2010 Sudan household survey (SHHS).

We excluded from the cost-effectiveness analysis those interventions that are not modelled in LiST – the use of iodized salt and the livelihood/food security and social protection related interventions. While recognising that the impacts of these interventions on undernutrition and child mortality have no conclusive scientific basis, several studies have demonstrated significant positive effects on nutritional status³⁵. **For this reason our estimates are likely to underestimate the number of deaths prevented (lives saved), cases of stunting averted and, in general, the overall benefits of all the scenarios presented.**

The linkages between risk factors, interventions and mortality in LiST are outlined by Figure 9.

5.3. Expected Results – What Can Be Achieved?

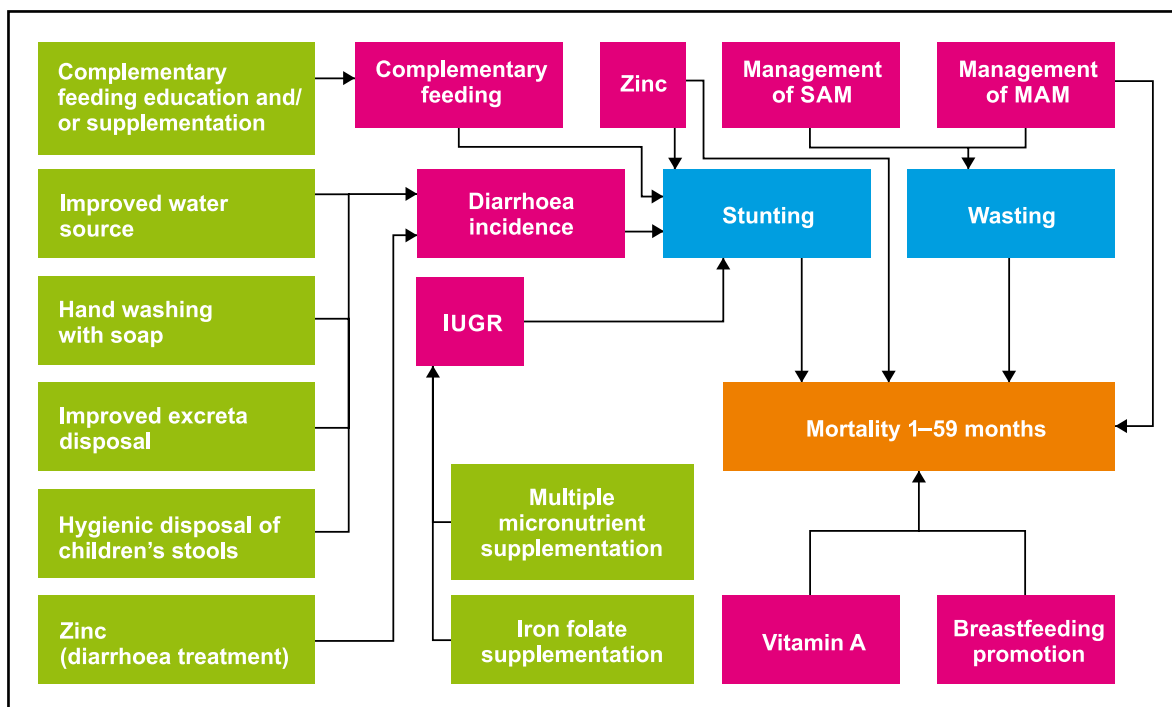
Scaling up the three packages of direct nutrition actions and nutrition-sensitive interventions to 90 per cent national coverage would give the **most cost-effective returns** in terms of

reducing undernutrition and mortality in Sudan. This would be coupled with the highest number of lives saved and cases of stunting averted.

The **expected benefits from achieving 90 per cent coverage nationwide** for the package of direct nutrition actions and nutrition-sensitive interventions modelled in LiST would be remarkable:

- **Under-five mortality rate** would be reduced from 73/1,000 live births to 49/1,000 live births; over 100,000 additional lives of children under five years of age would be saved during the period 2015–2019
- **Stunting** prevalence would be reduced from 35 per cent to 25 per cent over the five year period; more than 0.5 million additional cases of stunting among children 6–59 months would be averted
- **Wasting** (GAM prevalence) would be reduced from 16.5 per cent to 6 per cent between 2015 and 2019; 1.9 million children 6–59 months would be treated for SAM using the community-based management approach; 5 million children aged 6–59 months and pregnant and lactating women would receive complementary food for the treatment of moderate malnutrition

Figure 9. Linkages between risk factors, interventions and mortality in LiST



³⁵ For a study of the impacts of agriculture interventions on nutrition see Food and Agriculture Organization of the United Nations (2013). *Synthesis of Guiding Principles on Agriculture Programming for Nutrition*, FAO, Rome, Italy. p. 13. (<http://www.fao.org/docrep/017/aq194e/aq194e.pdf>). For cash transfer and other non-nutrition sectors see WHO e-Library of Evidence for Nutrition Actions (eLENA) (<http://www.who.int/elena/titles/en/>).

- **Exclusive breastfeeding** would be increased from 41 per cent to 63 per cent; 7 million pregnant women and mothers with children 0–6 months would be reached by breastfeeding counselling and support programmes
- **Iron deficiency anaemia among pregnant women** would be reduced from 58 per cent to 26 per cent; 6 million pregnant women would receive iron-folic acid supplements as part of their antenatal care.

It is important to note, once again, that these results are to be considered highly conservative and an underestimate of the real benefits of scaling up the plans, as some of the nutrition-sensitive interventions included in the four scaling up scenarios are currently not modelled in LiST.

Under-five mortality rate (deaths per 1,000 live births)

With an under-five mortality rate of 73/1,000 live births (SHHS 2010), Sudan will not meet its MDG target (42/1,000 live births). However, scaling up interventions to provide 90 per cent coverage nationwide, will result in a reduction in mortality of 24/1,000 live births, bringing the rate in 2019 to 49/1,000 live births (Figure 10). The medium coverage scenario (50 per cent nationwide) would ensure a reduction of under-five mortality to 59/1,000 live births, while the UNICEF/WFP initial scale up plan will lead to a reduction to 68/1,000 live births. It is worth noting that the mortality rate will remain unchanged if the status quo (business as usual scenario) is maintained.

Figure 10. Projected reduction in under-five mortality rate (death per 1,000 live births)

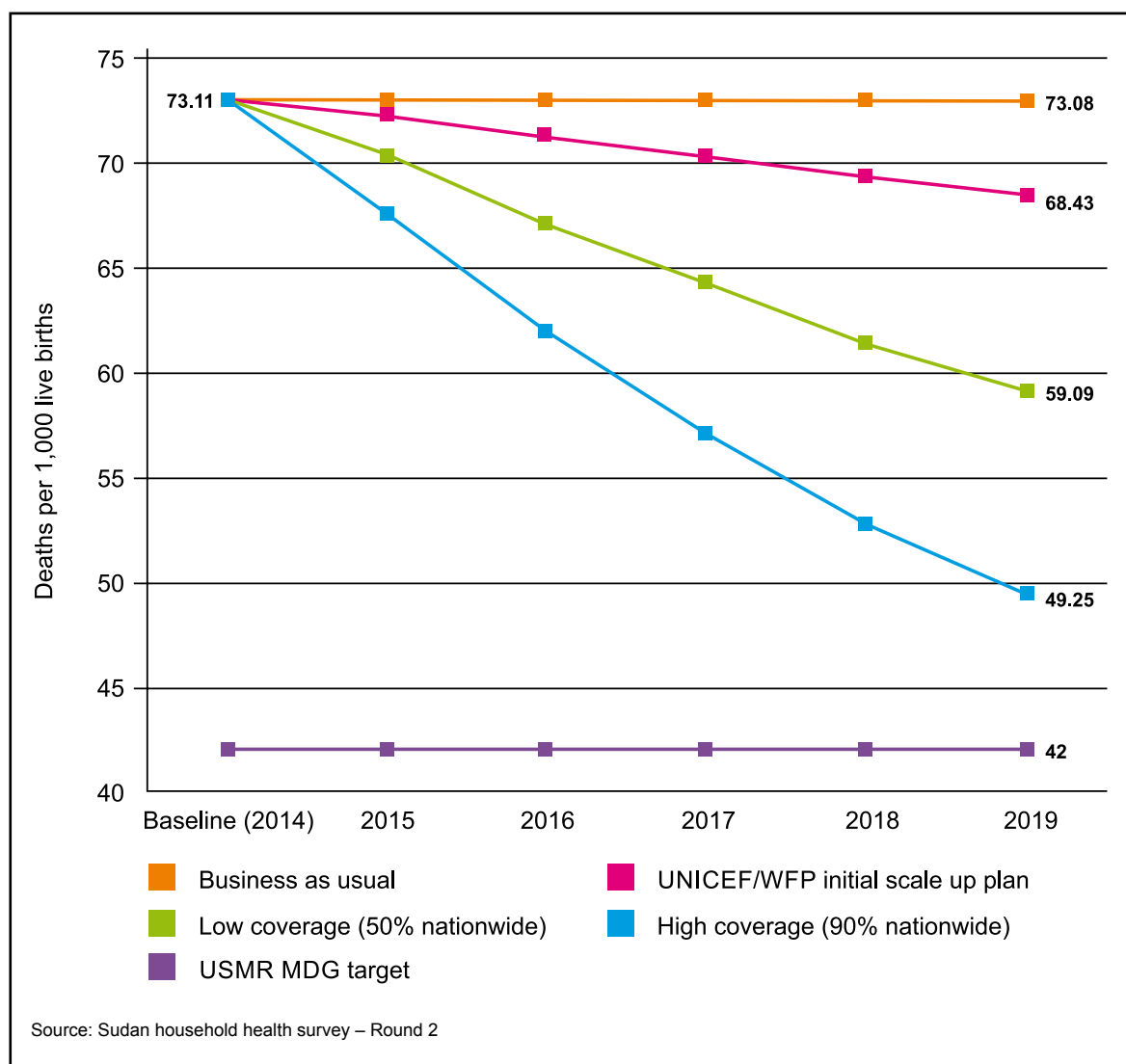


Table 7. Additional deaths prevented in children under five years of age

Scenario	Additional lives saved
1. Business as usual	-
2. UNICEF/WFP initial scale up plan	18,019
3. Medium coverage (50 per cent nationwide)	56,483
4. High coverage (90 per cent nationwide)	101,055

The projected additional number of lives saved during the five year period is 101,055 for the high coverage scenario and 56,483 for the medium coverage one. The additional number of deaths prevented by implementing the UNICEF/WFP initial scale plan (Table 7) is estimated at 18,019.

An analysis of the direct nutrition actions and sensitive interventions preventing death in children under five years of age (Figure 11) reveals the multi-sector nature of this investment case and the relevance of employing this approach. The top four interventions contributing to saving lives in 2019 will be from the health, nutrition and WASH sectors (oral antibiotics for pneumonia management, kangaroo care, therapeutic feeding for severe wasting and hand washing with soap).

Stunting

Experience has shown that a reduction in stunting can be achieved at an average annual rate of 1.5 per cent. Figure 12 shows the trend in stunting prevalence among children 6–59 months of age for the four scenarios. The projections show that the current level of stunting can be reduced by 1.62 per cent with the UNICEF/WFP initial scale up plan. It can be reduced by 5.7 per cent by scaling up the interventions to medium coverage nationwide and by 9.5 per cent with high coverage scaling up. Scaling up interventions to 90 per cent coverage nationwide will reduce the level of stunting among children 6–59 months to 25 per cent.

Figure 11. Additional deaths prevented in under-fives by intervention relative to impact year

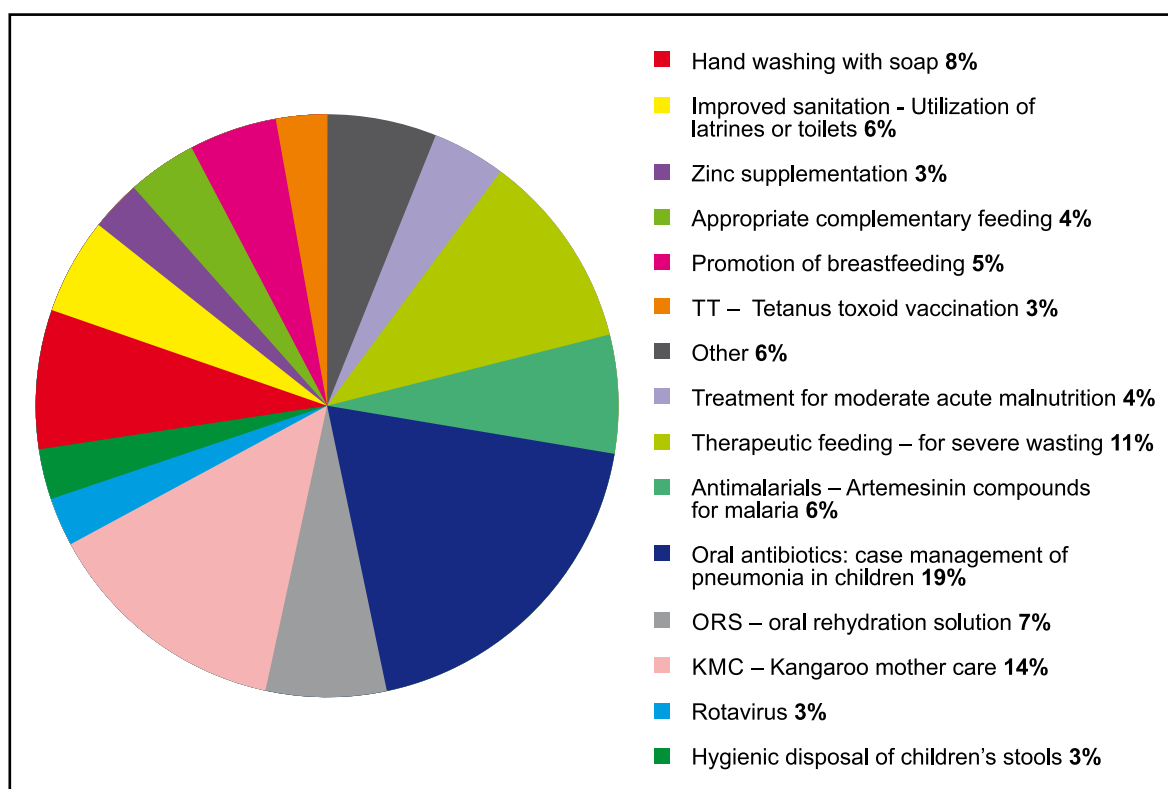


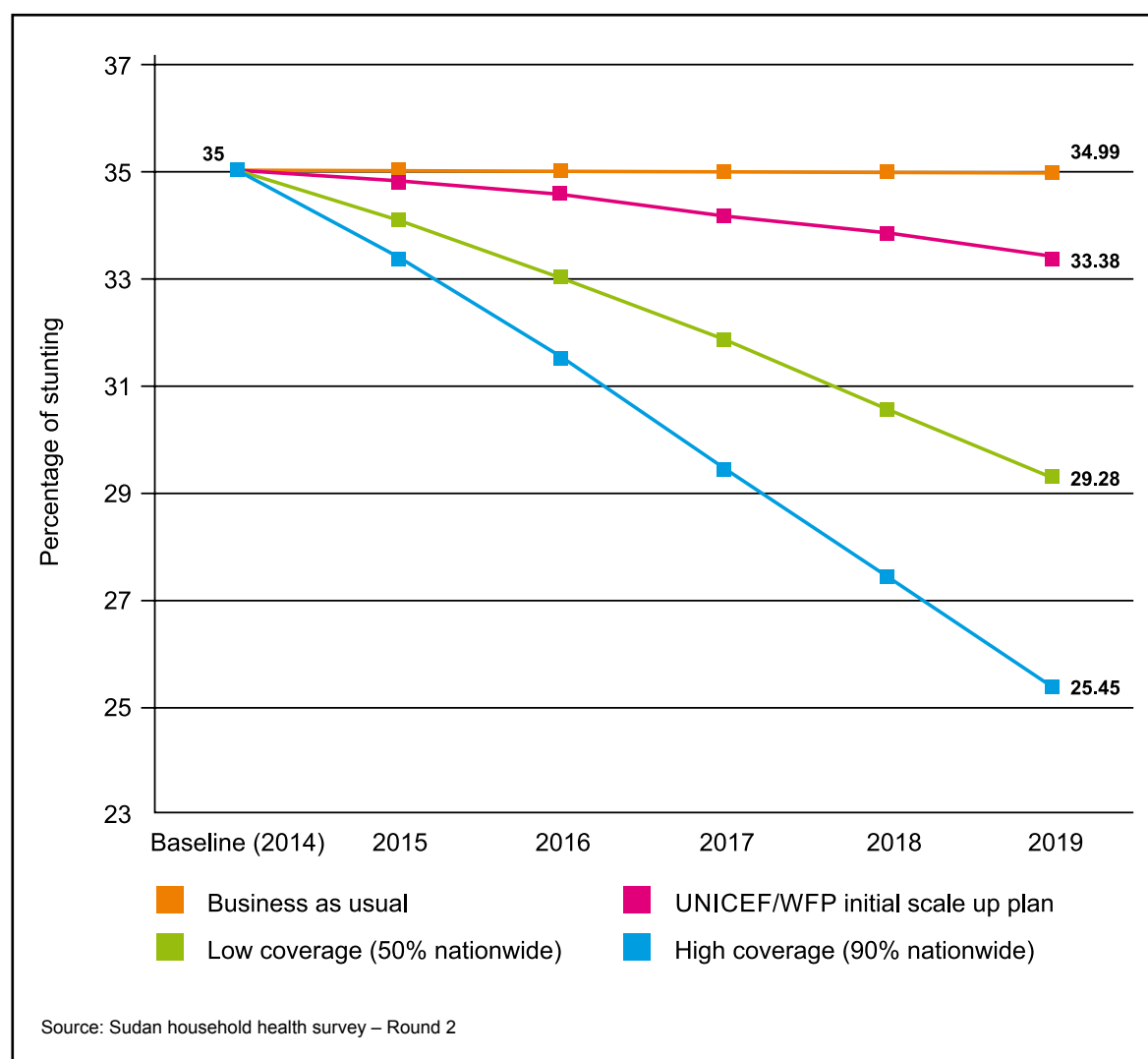
Table 8. Additional stunting cases averted in children under five years old, 2015–2019

Scenario	Additional cases of stunting averted
1. Business as usual	295
2. UNICEF/WFP initial scale up plan	91,111
3. Medium coverage (50 per cent nationwide)	321,427
4. High coverage (90 per cent nationwide)	536,389

Again, these results are to be considered conservative and underestimate the real reduction of stunting, as some of the key interventions having a significant impact on stunting and proposed in the packages currently are not modelled in LiST.

Table 8 shows the number of additional number of cases of stunting averted by the four scaling up scenarios. Scenario 4 would ensure the highest number of cases averted – 536,389 additional cases of stunting among children 6–59 months would be averted during the period 2015–2019 as compared with Scenario 1. Scenario 3 would avert 321,427 additional cases and Scenario 2, 91,111.

Figure 12. Projected reduction in stunting in children under five years old



Wasting

The only experience in reducing wasting comes from a country that was able to reduce the prevalence of SAM by 2.3 per cent in a year through full coverage with a preventative programme (including food supplements). Our projection takes into account the current low programme coverage, the weak capacity, the context, logistics, imperative for ensuring quality services and other factors. Therefore, scaling up interventions as per Scenario 2 will reduce nationwide wasting among children 6–59 months of age (GAM) by 3.8 per cent. It would be reduced by 4.7 per cent if the interventions were scaled up to 50 per cent coverage (Scenario 3) (Figure 13).

However, by increasing the coverage to 90 per cent nationwide (Scenario 4) GAM will decline by 10.5 per cent, bringing the prevalence rate to 6 per cent by 2019. The prevalence of MAM will

be reduced from 11.5 per cent to 4.5 per cent and SAM prevalence will be reduced from 5 per cent to 1.5 per cent.

Table 9 shows the number of additional cases of wasting averted by the four scaling up scenarios. The high coverage scenario would ensure the highest number of cases averted – 589,914 additional cases of wasting among children 6–59 months would be averted during the period 2015–2019. The medium coverage scenario would avert 265,598 cases and the UNICEF/WFP initial scale up plan scenario would avert 211,670 cases.

Exclusive breastfeeding

Our projection (Figure 14) showed a very modest increase in the rate of exclusive breastfeeding when scaling up in the five selected states only (Scenario 2). This is because the baseline for the five states is already reasonably high

Figure 13. Projected reduction in wasting prevalence in children under five years old

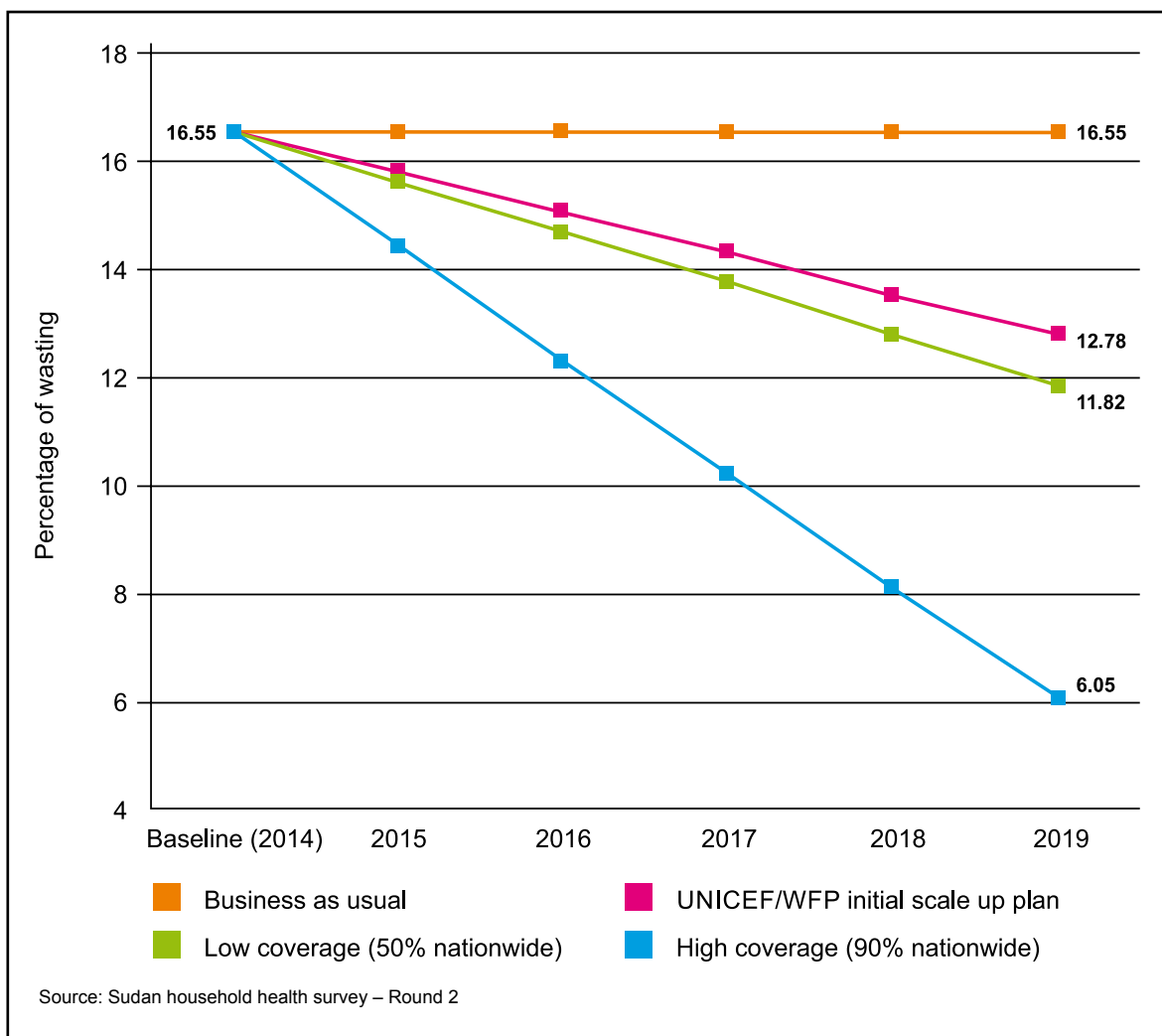
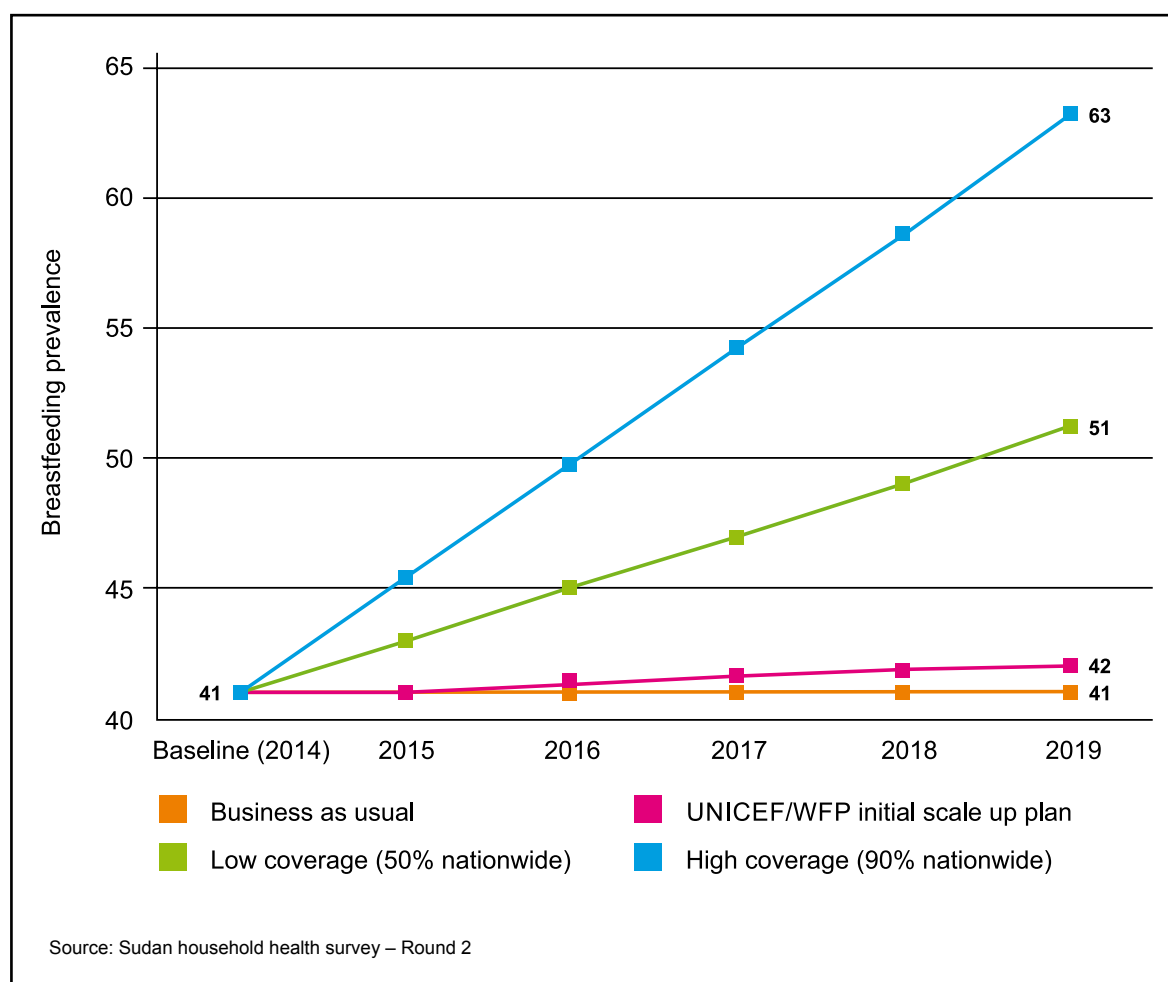


Table 9. Additional wasting cases averted in children under five years old, 2015–2019

Scenario	Additional cases of wasting averted
1. Business as usual	108
2. UNICEF/WFP initial scale up plan	211,670
3. Medium coverage (50 per cent nationwide)	265,598
4. High coverage (90 per cent nationwide)	589,914

Figure 14. Projected increase in exclusive breastfeeding rates



(66 per cent) as compared to the national baseline average (41 per cent).

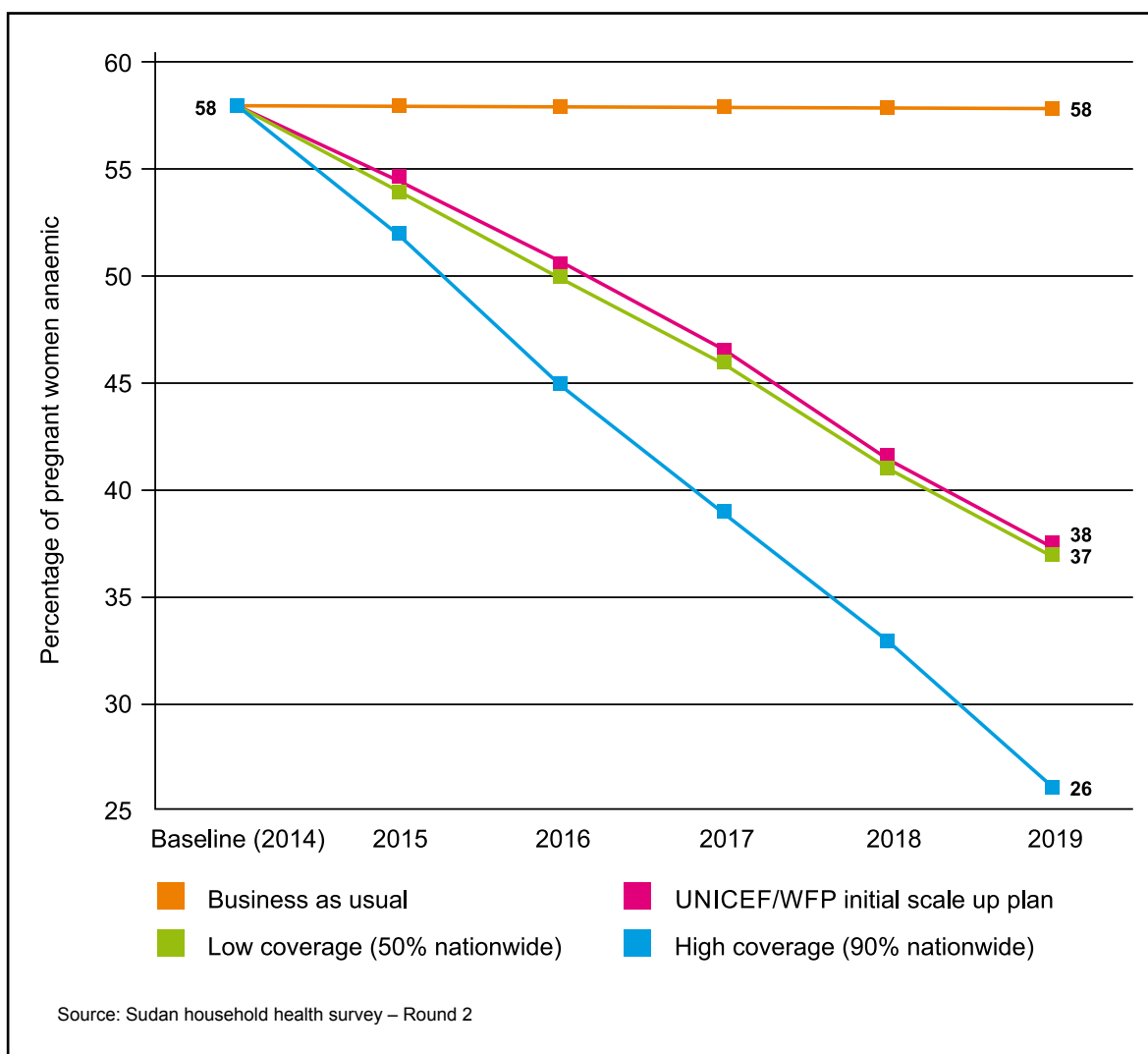
However, a nationwide coverage of 50 per cent will increase the breastfeeding prevalence to 51 per cent and a 90 per cent national coverage, to 63 per cent.

Anaemia in pregnant women

The WHO findings that show that 50 per cent of anaemia in women is a result of iron

deficiency were used as a starting point since iron supplements and/or multiple micronutrient supplements will have an effect on iron deficiency. Our analysis shows a remarkable reduction in anaemia in pregnant women – a 32 per cent decrease if the coverage is scaled up to 90 per cent nationwide. This will decrease the prevalence of anaemia to 26 per cent by 2019. There is no difference between outcomes of Scenarios 2 and 3 as they target the same level of coverage (70 per cent nationwide). In

Figure 15. Projected reduction in anaemia prevalence among pregnant women



both cases the reduction of anaemia in pregnant women will be 21 per cent over a five year period (Figure 15).

In all scenarios this is a considerable reduction in anaemia which could potentially improve maternal nutrition and significantly reduce the risk of maternal mortality. A projection for the rate of anaemia reduction in children has not been carried out as it is not available in LiST.

5.4 Cost-effectiveness and Value for Money

To determine the most cost-effective scenario providing the greatest value for money – the largest gain for each dollar spent – we first looked at which scenario would achieve the largest reduction in the prevalence of stunting for the least cost. For stunting we considered

only the costs of those interventions in LiST having an impact on stunting reduction – complementary feeding counselling and support, home fortification of food with micronutrients (including zinc), food-based prevention of MAM, use of an improved water source, improved excreta disposal, hand washing with soap, hygienic disposal of children’s stools, zinc for diarrhoea treatment and daily iron and folic acid supplements.

We then applied the same calculation to the additional number of deaths prevented in children under five years of age (lives saved), but accounting for the cost of the complete package of direct nutrition actions and nutrition-sensitive interventions with the exclusion of the use of iodized salt, labour intensive asset creation, food for training and conditional cash transfers, which are not currently modelled in LiST.

Table 10. Cost-effectiveness by scenario (stunting)

Scenario	Annual cost* (US\$ million)	Number of cases of stunting averted	Annual cost per additional stunting case averted (US\$)	Number of cases averted per US\$1 million invested
1. Business as usual	44	295	n/a	n/a
2. UNICEF/WFP initial scale up plan	76	91,111	836	1,196
3. Medium coverage (50 per cent nationwide)	184	321,427	572	1,748
4. High coverage (90 per cent nationwide)	286	536,389	534	1,873

* Includes only interventions in LiST which affect stunting.

Table 11. Cost-effectiveness by scenario (lives saved)

Scenario	Annual cost* (US\$ million)	Additional lives saved	Annual cost per additional life saved (US\$)	Number of lives saved per US\$1 million invested
1. Business as usual	80	-	n/a	n/a
2. UNICEF/WFP initial scale up plan	143	18,019	7,955	126
3. Medium coverage (50 per cent nationwide)	272	56,483	4,808	208
4. High coverage (90 per cent nationwide)	427	101,055	4,224	237

* Excludes use of iodized salt, labour intensive asset creation, food for training and conditional cash transfer.

Table 10 shows the cost-effectiveness of each scenario in terms of stunting reduction. Implementing Scenario 4 would ensure the lowest annual cost of averting an additional case of stunting (US\$ 534) while at the same time achieving the highest number of stunting cases averted (1,873) for each US\$1 million invested every year.

Table 11 shows the cost-effectiveness in terms of lives saved (additional number of death prevented). Scenario 4 appears to be the most cost-effective, with the lowest annual cost of

saving an additional life (US\$ 4,224) and the greatest number of lives saved for each US\$1 million invested (237).

All the cost-effectiveness ratios calculated in this analysis (annual costs per additional stunting case averted and lives saved) are considered 'cost-effective' based on the categorization used by WHO-CHOICE (Choosing interventions that are cost-effective)³⁶. An intervention is 'very cost-effective' if the ratio is less than the GDP per capita. An intervention is 'cost-effective' if it is between one and three times the GDP per

³⁶ WHO, *Cost effectiveness and Strategic Planning: Threshold Values for Intervention Cost-effectiveness by Region*, WHO-CHOICE (Choosing Interventions that are cost-effective) Programme, WHO, Geneva, Switzerland, <http://www.who.int/choice/costs/CER_levels/en>, 2013.

capita and 'not cost-effective' if it is more than three times the GDP per capita (Sudan's GDP per capita in 2013 was US\$1,753, World Bank national accounts data, World Development Indicators³⁷).

Although Scenario 4 is the most expensive, it is the most cost-effective way for scaling up investment in nutrition in Sudan. It would ensure the most cost-effective returns in terms of reducing malnutrition and mortality in Sudan. It also results in the highest number of lives saved and cases of stunting averted.



³⁷ <<http://data.worldbank.org/indicator/NY.GDP.PCAP.CD>>.

6. Funding Gap



In order to calculate the gap between the funding available and the estimated expenditures for each scenario, we looked at the funding available in terms of domestic and donor financing commitments. In the absence of reliable data on donors' commitments and government spending for intervention packages, we estimated the **funding available** for the period 2015–2019 based on the following assumptions:

- Government spending estimated at 9.5 per cent of the cost for the base year (2015) of the business as usual scenario, incremented by 10 per cent every year until 2019
- Donor commitments calculated from the information provided by the sectors for the years 2014/2015, also increased by 10 per cent every year until 2019. Funding information was verified against the Sudan Office for the Coordination of Humanitarian Affairs (OCHA) report on 'Requirements, commitments/contributions and pledges per cluster report as of 30-October-2014'³⁸.

Based on these assumptions, the estimated funding needed to invest for SUN in Sudan for the period 2015–2019 is US\$524 million for the five years (Table 12). This amount is significantly below the amount required to implement the recommended Scenario 4 (US\$2,620 million over five years), and can only cover Scenario 1.

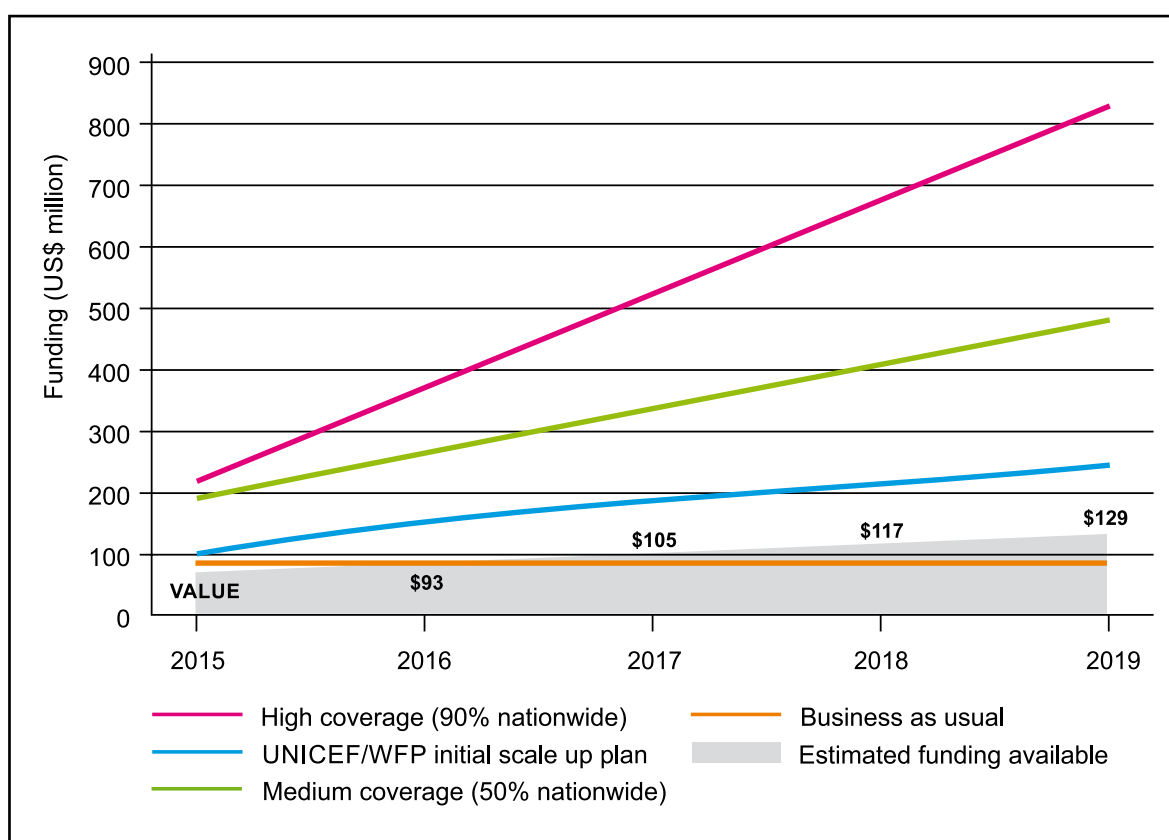
The magnitude of the funding gap is also well depicted by Figure 16, which shows how the funding gap between the cost of Scenario 4 and the funding available is more than US\$2 billion over the five year period. This figure may need to be revised when more accurate information about the government's and donors' financial commitments is available. However, the overwhelming view is that the resource shortfall is substantial and that additional financial support will be required.

³⁸ <[http://fts.unocha.org/reports/daily/ocha_R32sum_A1038___30_October_2014_\(12_30\).pdf](http://fts.unocha.org/reports/daily/ocha_R32sum_A1038___30_October_2014_(12_30).pdf)>.

Table 12. Estimated costs versus funding available 2015–2019 (US\$ million)

	2015	2016	2017	2018	2019	Total
<i>Estimated expenditures:</i>						
1. Business as usual	80	81	80	80	82	403
2. UNICEF/WFP initial scale up plan	98	154	188	213	243	897
3. Medium coverage (50 per cent nationwide)	187	265	337	408	481	1,678
4. High coverage (90 per cent nationwide)	218	373	523	674	832	2,620
Estimated funding available	80	93	105	117	129	524
<i>Funding gap:</i>						
1. Business as usual	0	13	24	36	47	120
2. UNICEF/WFP initial scale up plan	19	60	84	96	114	373
3. Medium coverage (50 per cent nationwide)	107	171	233	291	352	1,154
4. High coverage (90 per cent nationwide)	139	280	419	557	703	2,096

Figure 16. Projected estimated expenditures for different scenarios and the funding available 2015–2019 (US\$ million)



7. Implementation



This is a national investment case, which should be implemented in all 18 states at 90 per cent coverage to achieve substantial returns in reducing undernutrition and boosting human capital in Sudan. As a starting point, UNICEF and WFP have agreed to initiate the scaling up of nutrition by supporting the roll-out of an integrated multi-sector package of direct nutrition actions and nutrition-sensitive interventions in five states (Red Sea, Gedaref, Gezira, Central Darfur and Kassala). The interventions are grouped into three packages:

- Preventing undernutrition (both acute and chronic)
- Reducing child mortality
- Improving maternal nutrition.

In addition to the five states' CMAM frameworks, the two agencies will also support the implementation of home fortification with micronutrients, iron folate and vitamin A supplements, use of iodized salt and immunisation nationwide.

The implementation of Scenario 2 in the five states with the highest levels of malnutrition in Sudan will be a good starting point for rolling out the

proposed package of interventions. This will be particularly useful for identifying the bottlenecks in capacity, logistics and implementation that need to be addressed before going to scale nationally. Additionally, it will serve as a platform for advocacy and attract other stakeholders to join the efforts to address undernutrition at scale in Sudan.

The implementation will be done through three delivery modes – health system, community-based and population based. The main strategies suggested are:

- Capacity development and support for implementation
- Communication for social and behaviour changes
- Technical support at national and state levels for advocacy, coordination and management
- Supply chain and logistics management
- Operational research and knowledge management
- Monitoring and supervision.

The two agencies recognise that the pathways to improved nutrition are complex and multi-faceted. Hence policies and investments in other sectors are of enormous importance to nutrition outcomes. As much as possible, UNICEF and WFP will strive to identify mechanisms to enhance inter-sector synergies, particularly with education, social protection, child protection and gender equality, in the implementation of the proposed package.

7.1 Policy Implications

Scaling up nutrition will not be achieved without political commitment at both Federal and State levels, and the earmarking and mobilisation of sufficient financial resources. Significantly reducing the very high levels of undernutrition in Sudan will require strong and dedicated public action. Yet, without greater accountability, incentives for political leaders to act on undernutrition will remain limited. Developing political commitment for nutrition is essential to creating a policy environment where action on the ground can actually be taken.

Investments in the governance and stewardship functions of the government are also needed in order to translate policies into action on the ground and to promote accountability in the health system. Efforts should also focus on building institutional capacity and governance and promoting equity in access to services by

decentralising health systems and empowering states and local authorities. New evidence supports the notion that an equity-focused approach could bring vastly improved returns on investment by averting undernutrition, child and maternal deaths, and by significantly expanding the effective coverage of nutrition interventions and health services.

The analytical approach used to underpin this investment case has a number of advantages. First, it makes assumptions about costs and effects explicit and transparent. Second, it focuses policy attention and investment resources on those key binding constraints and specific system bottlenecks that are operating in the country. Third, it enables the government and their development partners to estimate financing needs on a rational and defensible basis and then allocate expenditures accordingly.

This investment package is financially sustainable. In principle, with sufficient political commitment, the Sudanese economy could have a sufficient level of economic growth to create the additional public fiscal space to invest in the nutrition required for the proposed package of interventions. But, given other competing priorities in the country's external development, financing to *accelerate* the implementation of an integrated package of interventions at scale will be required.

8. Conclusion



There is a strong case for investing in child and maternal nutrition globally. And there is even a stronger case for investing in nutrition in Sudan where undernutrition prevalence rates are still unacceptably high. The analyses conducted in this report highlight the need to expand the coverage of direct nutrition actions and nutrition-sensitive interventions to achieve significant results in reducing malnutrition and child mortality, and in improving maternal nutrition. It also indicates that the status quo (business as usual) approach imposes real costs on society, economic productivity, households and individuals.

The scenario recommended in this report (Scenario 4 – 90 per cent national coverage), although the most expensive, would ensure the most cost-effective returns by reducing malnutrition and mortality in Sudan. It will also ensure significant economic returns in the form of increased productivity of its labour force and an improved GDP.

It should be noted that the conclusions reached as to the size of the benefits estimated for this model are conservative and do not account for those nutrition-sensitive interventions not currently modelled in LiST.

Reaching 90 per cent coverage nationwide will require substantial additional expenditure by the government and its development partners. But the additional expenditure is financially and politically feasible and this analysis demonstrates that significant outcomes and impacts can be achieved and measured. This additional expenditure is also substantially cost-effective.

The financial and economic costs of inaction to Sudan are high. The ‘business as usual’ approach involves avoidable financial strains on the fragile budgets of the government and individuals. Failing to invest more now means further reductions in national productivity, both in the immediate term and in future generations.

Ultimately, the Sudan of tomorrow depends on investments in nutrition today. Sudanese leaders cannot afford to continue to squander Sudan’s most precious natural resource – its children. Great things can be achieved when the best possible science, sound strategies, adequate investment and political commitment combine.

Further Reading

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Appendix 1

Cost estimates by intervention and scenario 2015–2019

	Business as usual		UNICEF/WFP initial scale up plan		Medium coverage (50% nationwide)		High coverage (90% nationwide)	
	Cost per beneficiary (US\$)	Baseline coverage (%)	Estimated cost (US\$ thousands)	Geographic focus	Target coverage (%)	Estimated cost (US\$ thousands)	Target coverage (%)	Estimated cost (US\$ thousands)
<i>Prevention of undernutrition</i>			219,448			389,006		923,227
De-worming (children)	0.05	0			0		50	11
Pneumonia treatment (children)	3.21	69	5,237	5 states	80	6,872	50	11,447
Malaria treatment (children)	3.88	21	4,611	5 states	80	15,233	50	29,990
Measles vaccine	5.12	85	6,902	5 states	90	8,640	50	13,019
Rotavirus	6.72	0			0		50	11,396
Complementary feeding, couns. and supp.	17.40	37	14,302	5 states	50	21,010	50	54,986
Home fortification of food with micronutrients	6.94	7	820	All	31	12,332	50	20,031
Food-based prevention of MAM	83.20	7	93,071	All	15	101,922	50	284,330
Universal use of iodized salt	0.24	9	907	All	70	7,054	70	7,054
Use of improved water source	135.51	55	49,489	5 states	90	114,179	50	288,981
Improved excreta disposal	57.90	30	21,145	5 states	66	48,785	50	96,828
Hand washing with soap	31.44	30	11,482	5 states	66	26,490	50	52,577
Hygienic disposal of children's stools	31.44	30	11,482	5 states	66	26,490	50	52,577

	Business as usual	UNICEF/WFP initial scale up plan	Medium coverage (50% nationwide)	High coverage (90% nationwide)						
	Cost per beneficiary (US\$)	Baseline coverage (%)	Estimated cost (US\$ thousands)	Geographic focus	Target coverage (%)	Estimated cost (US\$ thousands)	Target coverage (%)	Estimated cost (US\$ thousands)	Target coverage (%)	Estimated cost (US\$ thousands)
<i>Reduction of child mortality</i>			171,730			313,037		405,736		615,057
ORS	1.44	15	5,201	5 states	35	10,237	50	36,235	90	42,140
Kangaroo	1.26	0			0		50	24	90	43
Zinc (diarrhoea treatment)	2.19	15	7,935	5 states	35	15,620	50	55,288	90	64,298
Breastfeeding counselling and support	8.76	65	15,851	5 states	80	21,576	50	36,793	90	61,313
Vitamin A supplementation	0.58	82	12,734	All	95	13,979	95	13,979	95	13,979
Management of SAM – inpatient	54.06	20	8,562	All	50	16,075	50	16,075	90	26,433
Management of SAM – outpatient	101.29	20	66,343	All	50	120,584	50	120,584	90	195,187
Treatment of MAM	41.80	21	55,104	All	41	114,966	50	126,758	90	211,664
<i>Improvement of maternal nutrition</i>			12,116			194,535		348,885		531,543
Pregnancy care – ANC	5.80	39	3,848	5 states	60	7,799	50	17,350	90	30,028
Postpartum care	1.26	0			0		50	3,771	90	6,527
Tetanus toxoid	0.33	0			0		50	769	90	1,385
De-worming (mothers)	0.22	0			0		50	15	90	27
Daily iron and folic acid supplementation	2.80	33	8,268	All	70	13,929	70	13,929	90	16,990
Food for assets (FFA), Food for training (FFT)	62.35	0		5 states	2	27,870	50	43,046	90	86,147
Conditional transfer (CT)	78.75	0		15 states	25	144,936	50	270,003	90	390,439
TOTAL			403,294			896,578		1,677,847		2,619,807



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