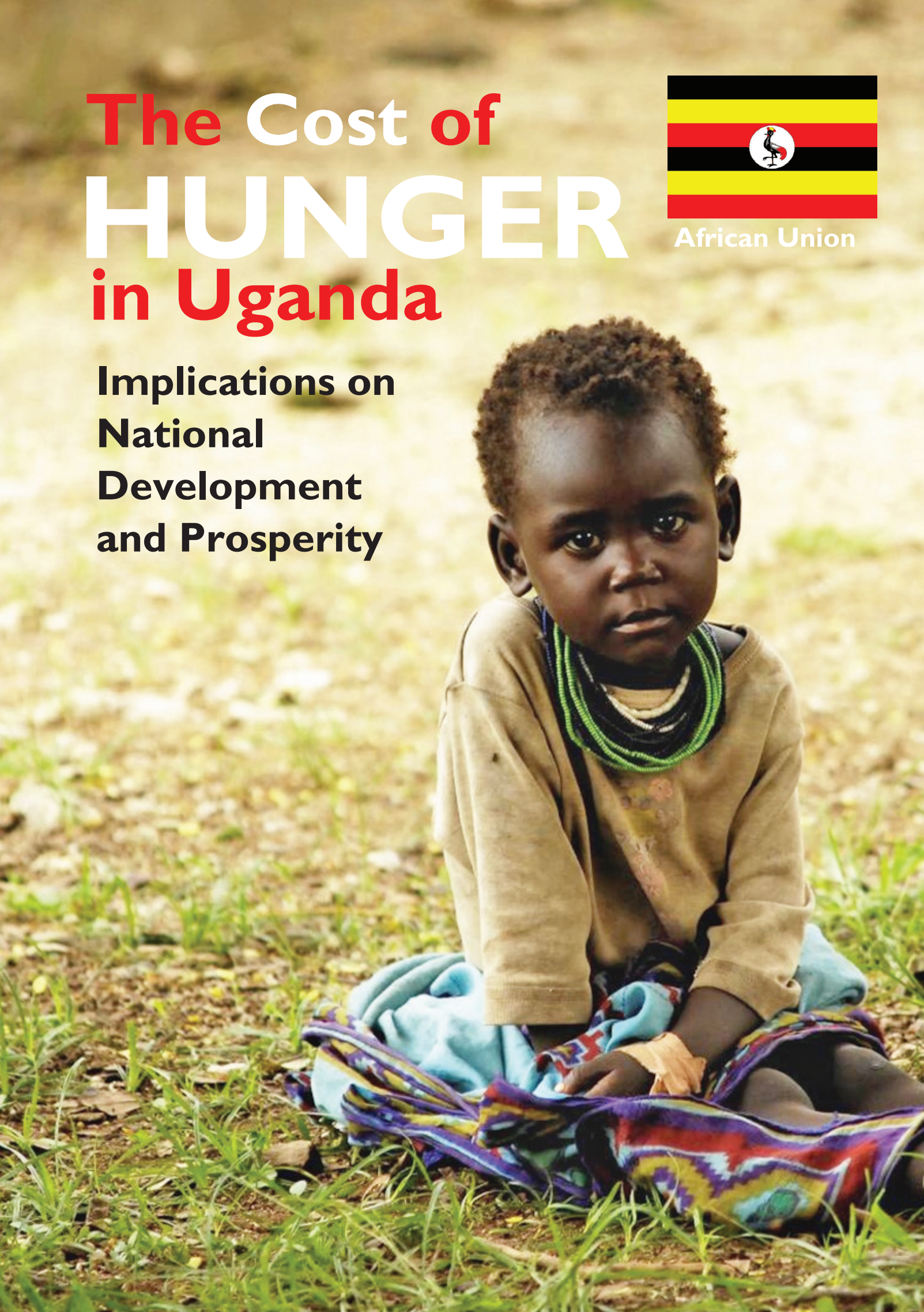
The Cost of HUNGER in Uganda

Implications on National Development and Prosperity



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Design: Rachel Quint, Addis Ababa, Ethiopia

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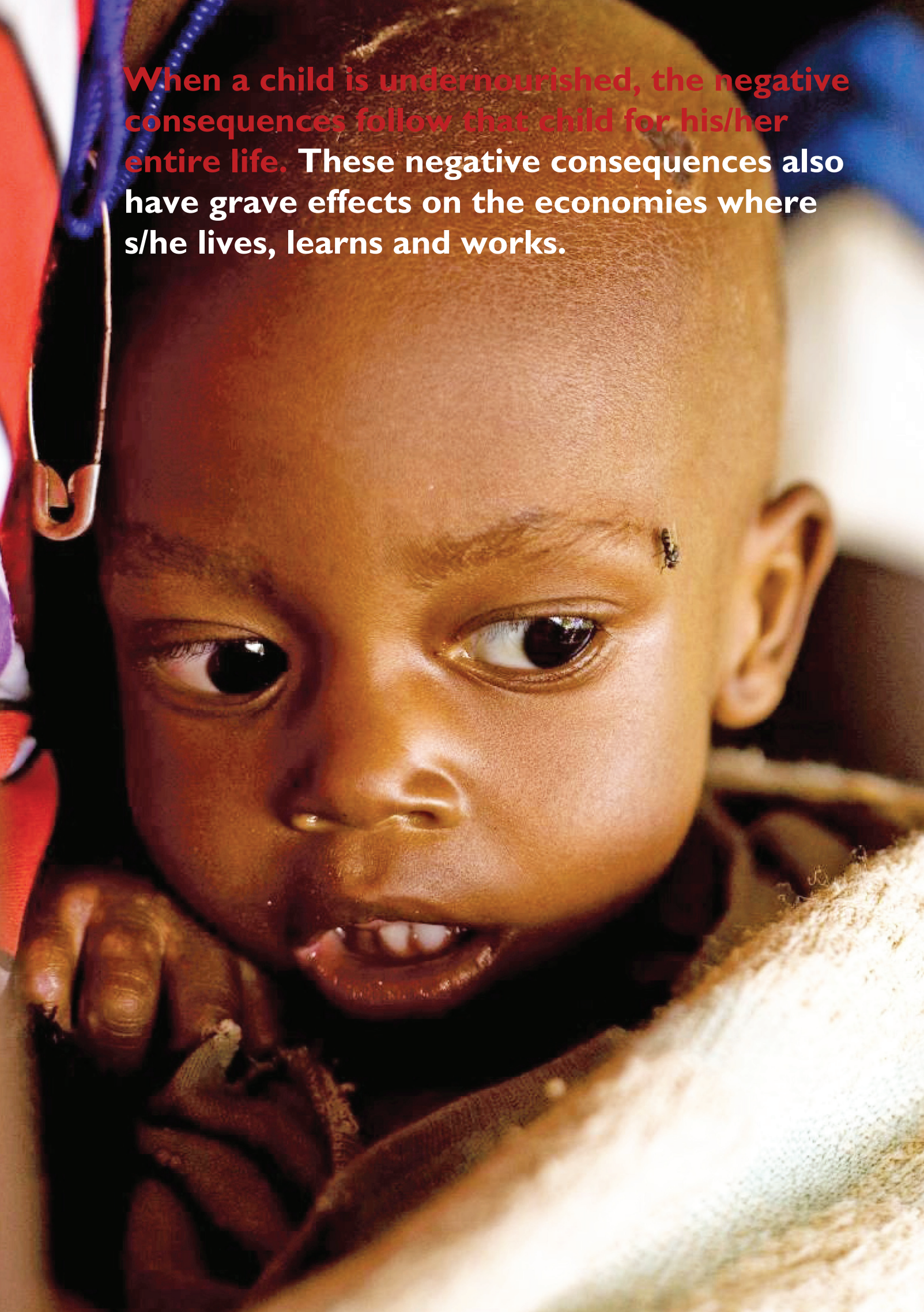
The Cost of HUNGER in Uganda

Implications on National Development and Prosperity

Social and Economic Impacts of Child Undernutrition in Uganda



When a child is undernourished, the negative consequences follow that child for his/her entire life. These negative consequences also have grave effects on the economies where s/he lives, learns and works.

Contents

Foreword

Uganda is committed to the transformation of its society from predominantly peasant to a modern and prosperous country by the year 2040.

The vision aims at turning Uganda into a competitive middle income country. To achieve this strategic milestone, the Government is ensuring peace, security and rule of law; fostering unity in diversity; guaranteeing equal opportunities to all; and investing in human development through healthcare and education for Ugandans.

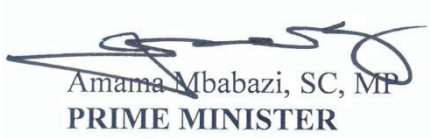
Uganda is currently experiencing tremendous strides in its economic and social development. This positive outlook on growth and foreign investment has enabled advances in both social and economic terms which are enabling the country to address key underlying factors that present barriers to national development.

This Cost of Hunger in Africa study that I am very pleased to commend to you, contends that investments in education and industry will not reach their full potential unless we ensure equal opportunities for our human capital.

This study is part of analytical work carried out to help support decision making at the highest level. The process was led by an inter-sectoral team of experts in statistics, health, education and nutrition drawn from the Office of the Prime Minister; Ministry of Health; Ministry of Education and Sports; Uganda Bureau of Statistics; National Planning Authority; Ministry of Finance, Planning and Economic Development; and the World Food Programme. Uganda being one of the pilot countries of this initiative, has contributed to the development of the overall analytical framework which was specifically adapted for Africa and that will be utilized and improved as the Cost of Hunger in Africa is rolled out to other countries in the region.

I must highlight the important contribution of this study to the continued institutional strengthening process. The process of data collection, processing, analysis usage of the results has been an opportunity for national experts to further build capacity to support evidence-based policy making.

I acknowledge the national leadership of the National Planning Authority in the development of this study. Special thanks go to the African Union Commission, the New Partnership for Africa's Development (NEPAD), and the United Nations Economic Commission for Africa (UNECA) and the World Food Programme (WFP) for this important contribution to informing nutrition stakeholders on the important implications of child undernutrition to the development of Uganda.



Amama Mbabazi, SC, MP
PRIME MINISTER

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The Ugandan Study was guided by a National Task Force comprising of the following: Dr. John Ssekamate, Head of Social Sector Planning (NPA), Dr. Robert Mwadime of FANTA 2, Dr. Elizabeth Madraa of GAIN, Peter Rukundo of Kyambogo University, Agnes Chandia Baku of the Ministry of Health, Susan Oketcho of the Ministry of Education and Sports, Alex Bambona of the Ministry of Agriculture, Animal Industry and Fisheries, Dr. Geoffrey Bisoborwa of the World Health Organisation, Beatrice Okello of the Food and Agriculture Organization of the United Nations, Julia Tagwireyi and Geoffrey Ebong of World Food Programme.

Special recognition has to be given to the National Implementation Team (NIT) in Uganda, which was responsible for collecting and processing data and presenting the final findings of the study. The NIT was coordinated by the National Planning Authority and led by Dr. John Ssekamate, Head of Social Sector Planning (NPA) with support from the Uganda Bureau of Statistics (UBOS). The following NIT members were also instrumental in the collection, processing, analysis of data and final report review: Lumala Patrick, Simon Sewakilyanga, Johnson Galande and Fiona Nattembo from UBOS; Martin Ahimbisibwe, Peace Nganwa, Dorothy Bushara Nabiwemba and Nancy Adero from the World Food Programme; Twaha Rwegema from the Ministry of Health; Evelyn Nakawuki and Sarah Naharamba from the NPA; Frank Senabulya and Gordon Mukasa from the Ministry of Education, Boaz Musiimenta, Senior Policy Analyst from the Office of the Prime Minister (OPM); and finally Dr. Henry Wamani from the Makerere University School of Public Health.

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The design and implementation of the study was directed by a Steering Committee jointly led by Menghestab Haile (WFP), Maurice Tankou (ECA), Ademola Olajide and Janet Byaruhanga from the Health, Nutrition and Population Division of the Social Affairs Department at the AUC and Boitshepo Bibi Giyose from the New Partnership for Africa's Development (NEPAD). Further institutional leadership to this project was provided by Nkosazana Dlamini Zuma, Chairperson,AUC; Carlos Lopes, Executive Secretary, ECA; Ertharin Cousin, Executive Director, WFP; and Ibrahim Mayaki, CEO, NEPAD.

Acronyms

ACGSD	African Centre for Gender and Social Development
ACS	African Centre for Statistics
ADFNS	Africa Day for Food and Nutrition
ADS	Acute Diarrheal Syndrome
AfDB	African Development Bank
ARI	Acute Respiratory Infection
ARNS	Africa Regional Nutrition Strategy
ATYS-VMD	Africa Ten Year Strategy for the Reduction of Vitamin and Mineral Deficiencies
AUC	Africa Union Commission
CAADP	The Comprehensive Africa Agriculture Development Programme
CEN-SAD	Community of Sahel-Saharan States
COHA	Cost of Hunger in Africa
COMESA	Common Market for Eastern and Southern Africa
DHS	Demographic and Health Survey
ECCAS	Economic Community of Central African States
ECLAC	Economic Commission for Latin America and the Caribbean
ECOWAS	Economic Community of West African States
EMIS	Education Management Information System
EDND	Economic Development and NEPAD Division, UNECA
FAFS	Framework for African Food Security
FAO	Food and Agriculture Organization
FTF	Feed the Future
GDP	Gross Domestic Product
GNI	Gross National Income
ICU	Intensive Care Unit
IFAD	International Fund for Agricultural Development
IGAD	Intergovernmental Authority for Development
ILO	International Labour Organization
IMAM	Integrated Management of Acute Malnutrition
IUGR	Intra Uterine Growth Retardation
LBW	Low Birth Weight
MAAIF	Ministry of Agriculture, Animal Industry and Fisheries
MDGs	Millennium Development Goals
MoES	Ministry of Education and Sports
MoH	Ministry of Health
NCHS	National Centre for Health Statistics
NEPAD	The New Partnership for Africa's Development
NGO	Non Government Organization
NIT	National Implementation Team
NPA	National Planning Authority
NPCA	NEPAD Planning and Coordinating Agency
OECD	Organization for Economic Cooperation and Development
OPM	Office of the Prime Minister
PANI	Pan- African Nutrition Initiative
P4P	Purchase for Progress
PSS	Public Social Spending
REACH	Renewed Efforts Against Child Hunger
REC	Regional Economic Communities
SADC	Southern African Development Community

SAM	Severe Acute Malnutrition
SCU	Special Care Unit
SUN	Scaling Up Nutrition
UBOS	Uganda Bureau of Statistics
UMA	Union du Maghreb Arabe
UMIS	Uganda Malaria Indicator Survey
UNECA	United Nations Economic Commission for Africa
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNHS	Uganda National Household Survey
UNICEF	United Nations Children's Fund
UGX	Ugandan Shillings
USAID	United States Agency for International Development
WAP	Working Age Population
WFP	World Food Programme
WHO	World Health Organization

Executive Summary

The Cost of Hunger in Africa (COHA) is an African Union Commission (AUC) led initiative through which countries are able to estimate the social and economic impact of child undernutrition in a given year. Twelve countries are initially participating in the study. Uganda is part of the four first-phase countries, the first to carry out the study and present results.

The COHA study illustrates that child undernutrition is not only a social, but also an economic issue, as countries are losing significant sums of money as a result of current and past child undernutrition. To that end, in March 2012 the regional COHA study was presented to African Ministers of Finance, Planning and Economic Development who met in Addis Ababa, Ethiopia. The Ministers issued a resolution confirming the importance of the study and recommending it continue beyond the initial stage.

The COHA study in Uganda was led by National Planning Authority (NPA), with support from the Uganda Bureau of Statistics (UBOS), the Ministry of Health, Ministry of Education, the Office of the Prime Minister (OPM) and the World Food Programme (WFP). At regional level, the COHA project is being led by the African Union Commission (AUC) with technical leadership from the United Nations Economic Commission for Africa (UNECA) and support from WFP and the New Partnership for Africa's Development (NEPAD).

During the process, all data for the study were collected from national data sources including the Uganda National Household Survey (UNHS) 2009-2010, Population and Housing Census 2002, Demographic and Household Survey (DHS) 2011 and previous DHS studies published by UBOS, demographic data from the African Centre for Statistics (ACS) and UN Population Division, as well as primary data collection.

Methodology

The COHA model is used to estimate the additional cases of morbidity, mortality, school repetitions, school dropouts and reduced physical capacity that can be directly associated to a person's undernutrition status before the age of five. In order to estimate these social impacts for a single year, the model focuses on the current[1] population, identifies the percentage of that population who were undernourished before the age of five, and then estimates the associated negative impacts experienced by the population in the current year. Using this information and the economic data provided by the Uganda National Implementation Team (NIT), the model then estimates the associated economic losses incurred by the economy in health, education and in potential productivity in a single year.

Trends in child stunting

Uganda has made important progress in the reduction of child undernutrition in the last few years. According to the 2011 DHS survey, approximately 33.4% of Ugandan children underfive were suffering from low height for their age (stunting), which represents an important improvement from the 38% reported by DHS in 2006. Additionally, the prevalence of underweight children has also improved from 16.4% to 13.8%. For that same period, low birth weight (LBW) in children has also maintained their level at around 10%. Nevertheless, it is estimated that 2.3 of the 6.6 million children under the age of five in Uganda are still affected by stunting and almost one million of children are underweight. This situation is especially critical for children between 24 and 59 months, where two out of every five children are affected by stunting.

Initial Results: The social and economic cost of child undernutrition in Uganda

Overall results in Uganda show that an estimated 1.8 trillion Ugandan shillings (UGX) were lost in the year 2009 as a result of child undernutrition. This is equivalent to 5.6% of GDP.

[1] The model set 2009 as the base year, given the availability of data for that year and in order to ensure the continuity of the study.. As it is the most recent possible study year, it is referred to as "current" in this report.

- For 2009, there were an estimated 1.6 million additional clinical episodes associated to undernutrition in children under five, which incurred a cost of an estimated 525 billion UGX. Cases of diarrhoea, fever, respiratory infections and anaemia totalled 495 thousand episodes in addition to the 1.1 million cases of underweight children. According to the estimated data, only one out of every five of all episodes received proper health attention.
- Undernutrition was associated to 15% of all child mortalities, which represented over 19,000 child deaths in 2009 and over 110,000 for the period from 2004 to 2009.
- Stunted children have a higher grade repetition rate at 12.2%, compared to non-stunted children at 9.1%. This incremental rate generated 133,000 additional cases of grade repetition in 2009, during which the education system and families incurred a cost of 19.7 billion UGX.
- Stunted children in Uganda are also more likely to drop out of school. Based on the information from the UNHS 2009-2010, the model estimated that for 2009 the average schooling timeloss for a person who was stunted as a child is 1.2 years lower than that of a person who was never undernourished. The resultant disadvantage in the labour market is estimated to have generated private costs of 241 billion UGX in potential productivity loss for that single year.
- 54 per cent of adults in Uganda suffered from stunting as children. This represented more than 8 million people of working age who were not able to achieve their potential as a consequence of child undernutrition. In rural Uganda, where most people are engaged in manual activities, it is estimated that in 2009 alone, 417 billion UGX were not produced due to a lower capacity of this group.
- Lastly, an estimated 943 million working hours were lost in 2009 due to absenteeism from the workforce as a result of nutrition-related mortalities. This represents 657 billion UGX, which is equivalent to 2% of the country's GDP.

Analysis of scenarios

In addition to calculating a retrospective cost for 2009, the model also can highlight potential savings, based on three scenarios. The three scenarios are described by the chart and graph below. These scenarios are constructed based on the estimated net present value of the costs of the children born in each year, from 2009 to 2025. The methodology follows each group of children and, based on each scenario, estimates a progressive path towards its achievement.

Scenario	**Baseline:** The Cost of Inaction by 2025	**Scenario #1:** Halving the Prevalence of Child Undernutrition by 2025	**Scenario #2.** The 'Goal'Scenario: "10 and 5 by 2025"
Description	Prevalence of stunted and underweight children stops at the level recorded in 2009 (35.5% and 14.8 respectively)	Prevalence of stunted and underweight children is reduced to half of 2009 (17.8% and 7.4% respectively)	Prevalence of stunted children is reduced to 10% and underweight children of less than five years of age, to 5%
Implications	No increase or decrease in percentage points but an increase in total number of stunted children and a higher burden on the society	A constant annual reduction of **1.1% points in the prevalence of stunting** is required	A constant annual reduction of **1.6% points in the prevalence of stunting** is required
Estimated Change in period	Cost increase of up to 26% by 2025 compared to the values in 2009	Accumulated savings of 2.9 trillion UGX for the period from 2009 to 2025	Accumulated savings of 4.3 trillion UGX for the period from 2009 to 2025
Annual Average Savings	none	179 billion shillings ($US88 million)	266 billion shillings ($US131 million)

Summary of conclusions and recommendations

The Cost of Hunger in Africa (COHA) Study presents an opportunity to better understand the role that child nutrition can play as a catalyst for social and economic transformation and human development. In Uganda, the results of the COHA study strongly suggest that, to achieve sustainable human and economic growth, special attention must be given to addressing nutrition in the early stages of an individual's life. The study estimates that child undernutrition generates health costs equivalent to 11% of the total public budget allocated to health, and that 15% of all cases of child mortality are associated with the higher risk of undernutrition. With regards to education, the results show that 7% of all grade repetitions in school are associated to the higher incidence of repetition experienced by stunted children.

Some of the key findings of the study indicate the need for scaling-up current interventions and developing innovative solutions to fight child undernutrition in Uganda. Going forward, it is recommended that the Government of Uganda promotes access to and the utilization of essential health services; scales up food fortification for school going children and children older than 6 months; explores further opportunities in bio-fortification; and addresses bottlenecks that undermine the efficiency of existing interventions, thus maximizing the results achieved through these interventions.

Section I: Brief Socio-Economic and Nutritional Background

I Brief Socio-Economic and Nutritional Background

In the year 2009 the Gross Domestic Product (GDP) of the Republic of Uganda (hereafter referred to as Uganda) was 32,505.34 billion Ugandan shillings[2]. The per capita Gross National Income (GNI) was approximately $US510.0 and had doubled in the last decade. There were also high levels of inequality (with a GINI index of 44.3) and food insecurity (with a Global Hunger Index categorized at "serious") due to undernourishment, child undernutrition and child mortality, which presented important challenges for the country's development[3].

TABLE I.1
SOCIO-ECONOMIC INDICATORS

Indicators	2000-2002	2005-2007	2009-2011
GDP, total in billions of Uganda shillings[4]	11,672	22,854	32,505 (2009)
GNI Per Capita (Atlas Method current $US)	250	380	510
Poverty - $1.25 a day (PPP) (% of population)	57.4	51.5	38
Population below the National Poverty Line (% of the Population)[5]	…	31.1	24.5
GINI Index	45.8	42.6	44.3
Labour Force, total (in millions)	10.7	12.1	13.4
Rural Population, percentage	87.5	86	84.4
Percentage of Population in Agriculture	66	72	66
Unemployment, % of total labour force	3.5	2	4.2
Unemployment, youth total (% of total labour force ages 15-24)	…	4.4	5.4
Population Growth (Annual %)	3.19	3.25	3.19
Life expectancy at birth, total (years)	47.5	51.7	54.1

Source if not otherwise noted: World Bank Database[6]

Poverty remains a significant challenge for Ugandans. In 2009-2010 approximately 7.5 million Ugandans lived in 1.2 million households considered poor, representing 24.5% of the country's population. The incidence of poverty is higher in rural areas where approximately 27.2% of the population lives below the poverty line, as compared to 9.1% in urban areas. This illustrates a higher burden of poverty on rural communities; rural populations represent 85% of the population constituting however, a disproportionate 94% of the national poverty burden[7].

[2]"World Economic Outlook Database October 2012," World Economic Outlook Database October 2012, October 2012, http://www.imf.org/external/pubs/ft/weo/2012/02/weodata/index.aspx.

[3]Klaus Von. Grebmer, "Financial crisis adding to the vulnerabilities of the hungry," *2009 Global Hunger Index: The Challenge of Hunger, Focus on Financial Crisis and Gender Inequality,* Bonn, Welthungerhilfe, 2009, p. 18.

[4]"World Economic Outlook Database," IMF, accessed March 15, 2013, http://www.imf.org/external/pubs/ft/weo/2012/02/weodata/index.aspx.

[5]*2012 Statistical Abstract*, report (Ugandan Bureau of Statistics), http://www.ubos.org.

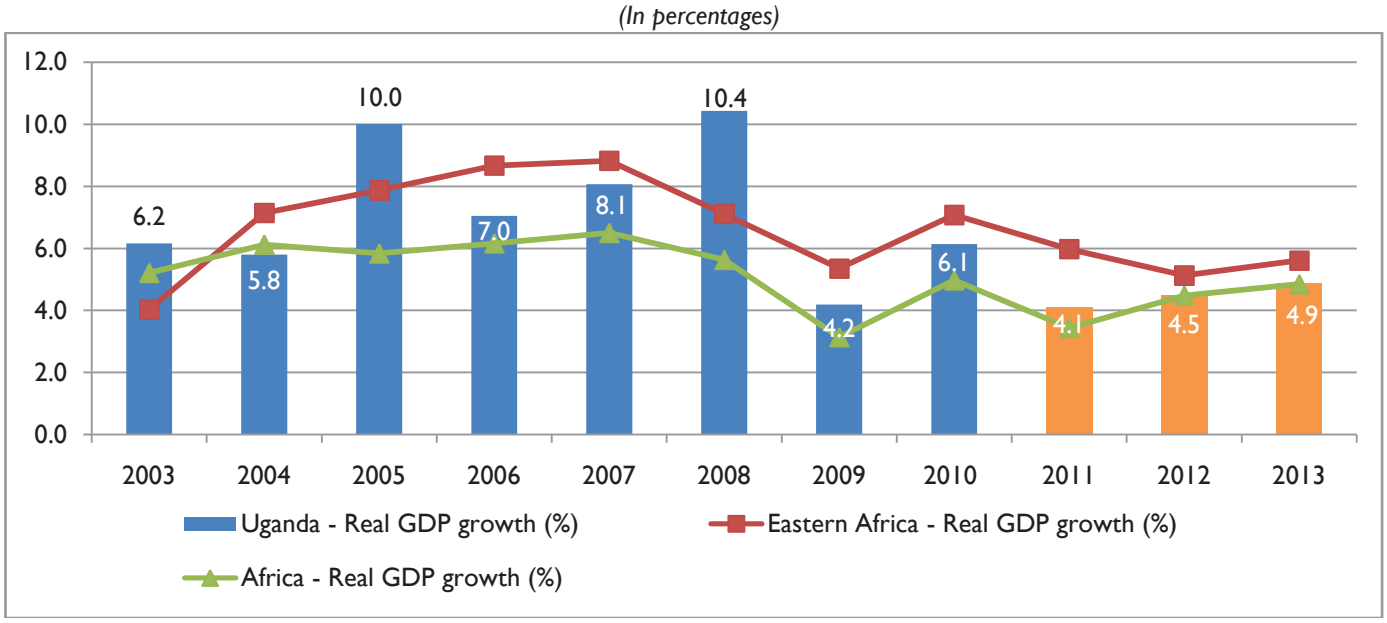
[6]"Uganda," Data, accessed March 15, 2013, http://data.worldbank.org/country/uganda.

[7]*2012 Statistical Abstract*, Report, Ugandan Bureau of Statistics, http://www.ubos.org.

Uganda's labour market is highly dependent on self-employment with only 21% of the population working as paid employees. Although the contribution of agriculture to total GDP has been declining over the years, the sector has continued to dominate the Ugandan economy. According to official estimates, agriculture contributed approximately 21% of the total GDP in 2009 and 90% of the total export earnings with coffee remaining the predominantly exported cash crop[8]. Furthermore, more than one third of the working population is engaged in manually intensive activities such as agriculture, forestry and fishing industry. Although the country has been able to maintain relatively low levels of unemployment, the rate for youth labour is higher than that of the general population, which presents a challenge to providing quality employment for young people.[9]

Uganda's economy has experienced a positive trend in the last decade, with growth rates that exceeded 10% in 2008. Nevertheless, recently the economy has experienced a slowdown with high inflation rates and currency depreciation. Even with these constraints, there is a positive outlook for 2012 and 2013 driven in part by the oil sector.[10]

FIGURE I.1
TRENDS IN REAL GDP GROWTH, 2003-2013
(In percentages)



Source: African Economic Outlook, Figures for 2010 are estimates; for 2011 and later are projections

Social investment levels have also been consistent in the last few years, contributing to a positive social outlook. Investments in health have been well above the regional average, with levels as high as 9% of the GDP in recent years. On the other hand, investments in education have decreased proportionally from 3.8 to 3.2 % of the GDP,[11] below the regional average, which is 4.6% for Sub Sahara.[12]

TABLE I.2
SOCIAL INVESTMENT INDICATORS

Indicators	2005-06	2007-08	2009-10	Sub-Saharan Africa *
Public spending on education, total (% of govern. expenditure)	…	18.9	15	18.8%
Public spending on education, total (% of GDP)	…	3.8	3.2	4.6%
Expenditure per student, primary (% of GDP per capita)	…	8.39	7.21	…
Expenditure per student, secondary (% of GDP per capita)	…	26.00	20.47	…
Health expenditure per capita (current $US)	33.35	45.32	46.72	84.3

[8] *2010 Statistical Abstract*, Report, Ugandan Bureau of Statistics, http://www.ubos.org.

[9] *Ibid.*

[10] "Uganda," African Economic Outlook, 2012, http://www.africaneconomicoutlook.org/en/countries/east-africa/uganda/.

[11] *2010 Statistical Abstract*, Report, Ugandan Bureau of Statistics, http://www.ubos.org.

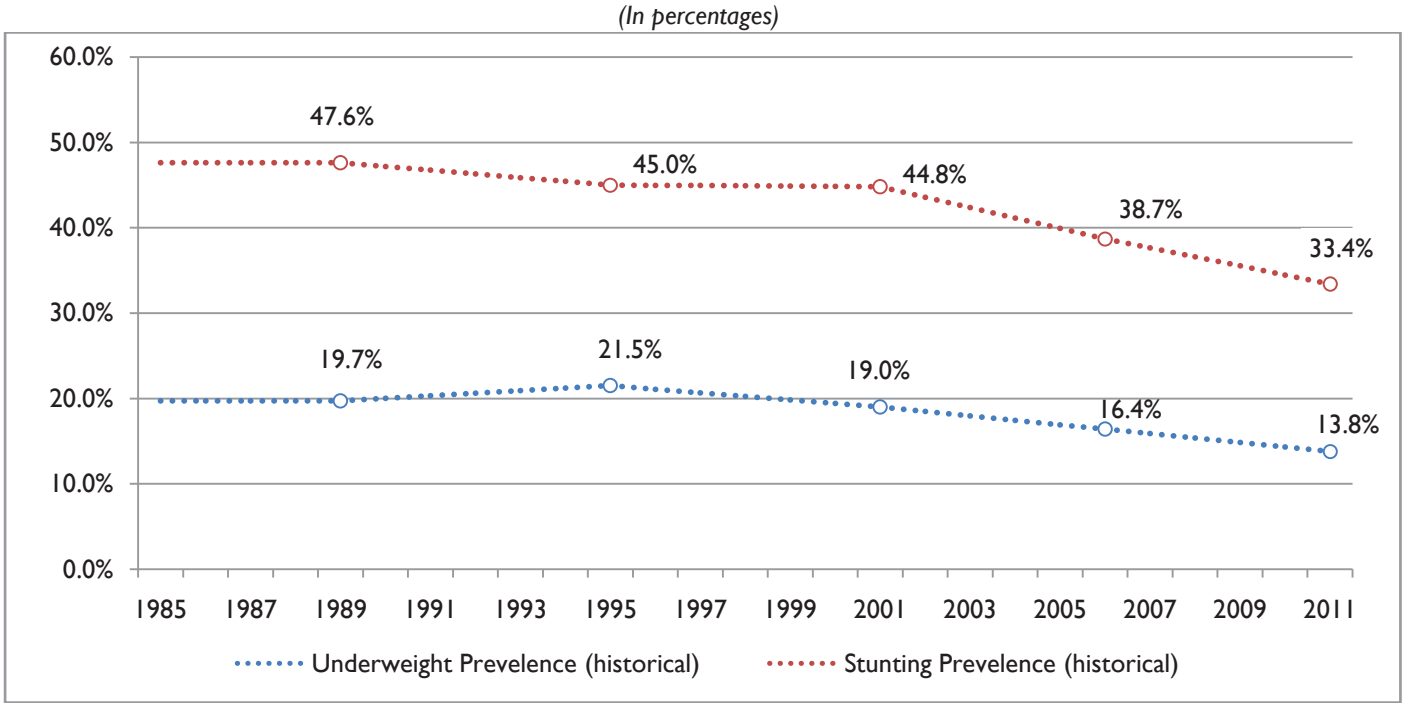
[12] "Public spending on education, total % of GDP," accessed March 13, 2013, http://data.worldbank.org/indicator/SE.XPD.TOTL.GD.ZS.

Indicators	2005-06	2007-08	2009-10	Sub-Saharan Africa *
Health expenditure, total (% of GDP)	8.9	8.6	9	6.5%
Health expenditure, public (% of total health expenditure)	21	17.2	21.7	45%

Source: World Bank Database, most recent year available * Developing countries only - Latest data available

The recent improvement in poverty rates has also been accompanied by a reduction in child undernutrition, particularly in stunting rates. According to the 2011 DHS survey, approximately 33.4% of Ugandan children under the age of five were suffering from low height for their age (stunting), which represents an important improvement from the 38% reported by DHS in 2006. Additionally, the prevalence of underweight children has also improved from 16.4% to 13.8%. For that same period, the level of low birth weight (LBW) prevalence in children has also maintained at around 10%.

Figure I.2
ESTIMATED UNDERNUTRITION TRENDS IN CHILDREN UNDER-FIVE, 1985-2010
(In percentages)



Source: Prepared based on information from DHS 2000/2005/2011

The current levels of child undernutrition illustrate the challenges lying ahead in the reduction of child hunger. It is estimated that 2.3 of the 6.6 million children under the age of five in Uganda were affected by stunting in 2009 and almost one million of children were underweight. This situation is especially critical for children between 24 and 59 months, where two out of every five children are affected by stunting.[13]

[13] *Uganda Demographic and Health Survey 2011,* Uganda Bureau of Statistics (UBOS) and ICF International Inc., Kampala, Uganda: UBOS and Calverton, Maryland: ICF International Inc., 2012.

TABLE I.3
POPULATION AND CHILD UNDERNUTRITION, 2009[c]
(Population in thousands)

Age groups	Population size	Low Birth Weight		Underweight		Stunting	
		Population affected	Prevalence[/b]	Population affected	Underweight prevalence	Population affected	Stunting prevalence
Newborn (IUGR)[a]	1,515	83	5.5%				
0 to 11 months				246	16%	267	18%
12 to 23 months	1,405			251	18%	546	39%
24 to 59 months	3,667			478	13%	1,469	40%
Total	6,587	83		975		2,282	

Source: Data for 2009 is estimated based on DHS surveys 2006/2011 and demographic projections

[a] In a given year, the new-born population is the same as the 0-11 month's age group.

[b] Estimated on the basis of the equation of De Onis et al, 2003.

[c] Data estimated from the most recent undernutrition prevalence figure available.

Section II: Cost of Hunger in Africa Methodology

II Cost of Hunger in Africa Methodology

A. Introduction: Why is it important?

Recently, Africa has been experiencing a steady economic growth that has positioned the continent as a key region for global investment and trade. The pace of real GDP growth on the continent has doubled in the last decade and six of the world's fastest growing economies are in Africa.[14]

Growth has been recorded despite some of the highest rates of child undernutrition in the world.

Human capital is the foundation of economic development. Improved nutritional status of people has a direct impact on economic performance through increased productivity and enhanced national comparative advantage. In order for Africa to maximize its present and future economic growth opportunities, increased efforts are needed for cost-effective interventions that address the nutritional situation of the most vulnerable members of the society.

Achieving nutrition and food security would generate immediate impact on the achievement of the Millennium Development Goals (MDGs). If child undernutrition were reduced, there would be a direct improvement in child mortality rates, as undernutrition is the single most important contributor to child mortality.[15] If girls were not undernourished, they would be less likely to bear underweight children. Further, healthy children would be more productive as adults and would have a higher chance of breaking the cycle of poverty for their families.

Undernutrition leads to a significant loss in human and economic potential. The World Bank estimates that undernourished children are at risk of losing more than 10 per cent of their lifetime earning potential, affecting thus national productivity. Recently, a panel of expert economists at a Copenhagen Consensus Conference concluded that fighting malnourishment should be the top priority for policy makers and philanthropists.[16] At that conference, Nobel Laureate Economist, Vernon Smith described that, "One of the most compelling investments is to get nutrients to the world's undernourished. The benefits from doing so – in terms of increased health, schooling, and productivity – are tremendous."[17] Improving the nutrition status is therefore a priority area that needs urgent policy attention to accelerate socio-economic progress and development in Africa.

However, despite a compelling economic case for nutrition interventions, investments with apparent shorter term returns are prioritized in social budgets. Hence, stronger efforts are required to sensitize the general population, policy makers and development partners on the high cost of undernutrition, in order to strengthen national and international political and financial commitments and to ensure that young children do not continue to suffer from undernourishment in Africa.

Positioning nutrition interventions as a top priority for development and poverty reduction is often difficult, partly due to the lack of credible country-specific data on short-term returns. There is not enough country-specific evidence to demonstrate how improved nutrition would have a direct impact on school performance and eventually in improving opportunities in the labour

[14]"World Economic Outlook Database October 2012", World Economic Outlook Database October 2012, October 2012, http://www.imf.org/external/pubs/ft/weo/2012/02/weodata/index.aspx.

[15]Robert E. Black et al., "Maternal and child undernutrition: global and regional exposures and health consequences," *The Lancet* 371, No. 9608, 2008, doi:10.1016/S0140-6736(07)61690-0.

[16] Copenhagen Consensus 2012, *Top economists identify the smartest investments for policy-makers and philanthropists,* 14 May 2012, http://www.copenhagenconsensus.com/Default.aspx?ID=1637.

[17]*Ibid.*

market and physical work. Additionally, nutrition is often looked at as a health issue, without considering the rippling social impact that it has on other areas of development.

Despite the aforementioned challenges, efforts continue, both at continental and global levels, to address the issues of undernutrition and hunger. At the regional level, these efforts include initiatives and strategies such as the *African Regional Nutrition Strategy*, the *Comprehensive Africa Agriculture Development Programme* (CAADP), especially CAADP Pillar III, which focuses on reducing hunger and improving food and nutrition security, the *Pan African Nutrition Initiative* (PANI), *Framework for African Food Security* (FAFS), *AfricaTen Year Strategy for the Reduction of Vitamin and Mineral Deficiencies* (ATYS-VMD), and African Day for Food and Nutrition Security (ADFNS). At the global level, initiatives include *REACH*, *Purchase for Progress* (P4P), *Scaling Up Nutrition* (SUN), *Feed the Future* (FTF), the "1,000 Days" partnership, as well as the *Abuja Food Security Summit* of 2006. All these efforts are designed to reduce hunger, malnutrition and vulnerability, in a bid to also achieve the MDGs.

Within the framework of the African Regional Nutrition Strategy (2005-2015)[18], the objectives of the African Task Force on Food and Nutrition Development[19] and CAADP, the African Union and the New Partnership for Africa's Development (NEPAD) Planning and Coordinating Agency (NPCA), the United Nations Economic Commission for Africa (UNECA), and the World Food Programme (WFP) undertook efforts to conduct the *Cost of Hunger Study on the Social and Economic Impact of Child Undernutrition in Africa*. This study is built on a model developed by the United Nations Economic Commission for Latin America and the Caribbean (ECLAC). Through a South-South collaboration agreement, ECLAC has supported the adaptation of the model to the African context.

This study aims at generating evidence to inform key decision makers and the general public about the cost African societies are already paying for not addressing the problem of child undernutrition. The results provide compelling evidence to guide policy dialogue and advocacy around the importance of preventing child undernutrition. Ultimately, it is expected that the study will encourage revision of current allocation practices in each participating country to ensure provision of the human and financial resources needed to effectively combat child undernutrition, specifically during the first 1,000 days of life when most of the damage occurs.

[18]African Regional Nutrition Strategy (2005-2015). Objectives I-III: I. To increase awareness among governments of the region, regional and international development partners and the community on the nature and magnitude of nutrition problems in Africa and their implications for the development of the continent and advocate for additional resources for nutrition. II. To advocate for renewed focus, attention, commitment and a redoubling of efforts by member states, in the wake of the worsening nutrition status of vulnerable groups. III. To stimulate action at the national and regional level that lead to improved nutrition outcome, by providing guidance on strategic areas of focus.

[19]African Union, "CAHM5 Moves into gear with meeting on food and nutrition development", 14 April 2011, http://www.au.int/en/sites/default/files/task%20force%20on%20food%20and%20nutrition%20development.pdf

B. Brief description of the model

i. Conceptual framework

Hunger is caused and affected by a set of contextual factors. "Hunger" is an overarching term that reflects an individual's food and nutrition insecurity. Food and nutrition insecurity occur when part of the population does not have assured physical, social and economic access to safe and nutritional food to satisfy dietary needs.

DEFINITION OF TERMS

1. Chronic Hunger: The status of people, whose food intake regularly provides less than their minimum energy requirements leading to undernutrition.[20]
2. Child Undernutrition: The result of prolonged low levels of food intake (hunger) and/or low absorption of food consumed. It is generally applied to energy or protein deficiency, but it may also relate to vitamin and mineral deficiencies. Anthropometric measurements (stunting, underweight and wasting) are the most widely used indicators of undernutrition.[21]
3. Malnutrition: A broad term for a range of conditions that hinder good health caused by inadequate or unbalanced food intake or from poor absorption of food consumed. It refers to both undernutrition (food deprivation) and over nutrition (excessive food intake in relation to energy requirements.[22]
4. Food insecurity: Exists when people lack access to sufficient amounts of safe and nutritious food, and therefore are not consuming enough for an active and healthy life. This may be due to the unavailability of food, inadequate purchasing power or inappropriate utilization at household level.[23]
5. Food vulnerability: Reflects the probability of an acute decline in food access or consumption, often in reference to some critical value that defines minimum levels of human wellbeing.[24]

Nutrition security therefore, depends on a person's food security or insecurity. Specifically, nutrition security can be described as, "appropriate quantity and combination of food, nutrition, health services and care taker's time needed to ensure adequate nutrition status for an active and healthy life at all times for all people."[25] A direct and measurable consequence of nutrition insecurity is low birth weight, underweight and/or lower than normal height-for-age.

Levels of nutrition security in a country are related to epidemiological and nutritional transitions, which can be evaluated to assess the population's nutritional situation. Further, a person's nutritional situation is part of a process that is expressed differently depending on the stage of the life cycle: intrauterine and neonatal life, infancy and pre-school, school years or adult life. This is because the nutrient requirements and the needs are different for each stage[26].

Below is the discussion of the central elements, considered in the model, to estimate the effects and costs of child undernutrition based on the concepts mentioned above, along with a brief description of the causes and consequences of undernutrition. The discussion also describes the dimension of analysis and the principal methodological aspects used to interpret the results.[27]

[20] "Hunger statistics", FAO Hunger Portal, Undernourishment or Chronic Hunger, FAO, accessed March 14, 2013, http://www.fao.org/hunger/en/.

[21] "Hunger statistics", FAO Hunger Portal, Undernutrition, FAO, accessed March 14, 2013, http://www.fao.org/hunger/en/.

[22] *Ibid.*

[23] *Ibid.*

[24] WFP, *VAM Standard analytical framework*, World Food Programme, 2002.

[25] USAID, *USAID Commodities reference guide*, Annex I: Definitions, January 2006, , http://transition.usaid.gov/our_work/humanitarian_assistance/ffp/crg/annex-1.htm.

[26] Rodrigo Martínez and Andrés Fernández, *Model for analysing the social and economic impact of child undernutrition in Latin America,* Naciones Unidas, CEPAL, Social Development Division, Santiago De Chile, 2007.

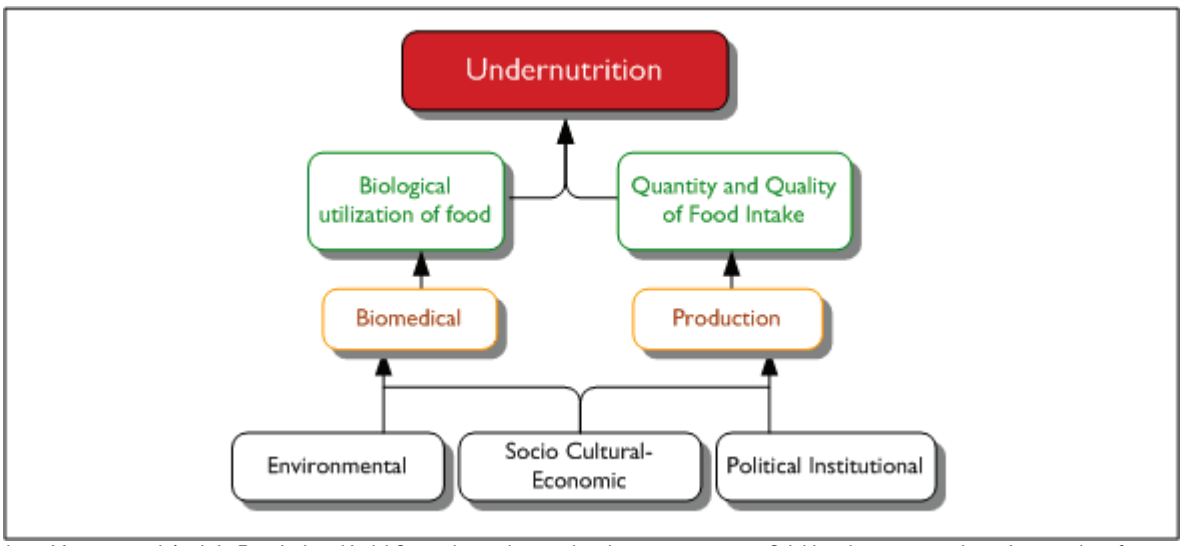
[27] A summarized version of the theoretical background and the basic characteristics considered in the model of analysis are presented. For a more detailed discussion of the model, see Rodrigo Martínez and Andrés Fernández, *Model for analysing the social and economic impact of child undernutrition in Latin America,* Naciones Unidas, CEPAL, Social Development Division, Santiago De Chile, 2007.

ii. Causes of undernutrition

The main factors associated with undernutrition, as a public health problem, can be grouped into the following: environmental (natural or entropic causes), sociocultural-economic (linked to poverty and inequality) and political-institutional. Together, these factors increase or decrease biomedical and productivity vulnerabilities, through which they determine the quantity and quality of dietary intake and the absorption capacity, which constitute the elements of undernutrition.[28]

Each of these factors helps increase or decrease the likelihood of a person to suffer from undernutrition. Further, the importance of each of these factors depends on the level of the country's demographic and epidemiological transition as well as on the person's current stage in the life cycle. Together these factors determine the intensity of the resulting vulnerability to undernutrition.

FIGURE II.1
CAUSES OF UNDERNUTRTION



Source: Rodrigo Martinez and Andrés Fernández, *Model for analysing the social and economic impact of child undernutrition in Latin America* (see footnote) based on consultations carried out by authors.[29]

Environmental factors define the surroundings in which the subject and his or her family live, including the risks stemming from the natural environment itself and its cycles (from floods, droughts, frosts, earthquakes, and other phenomena), and those produced by humans themselves (such as the contamination of water, air, and food, the expansion of agriculture into new territories, etc.). The socio-cultural-economic determinants include elements associated with poverty and equality, education and cultural norms, employment and wages, access to social security, and coverage of aid programmes. The political-institutional factors encompass government policies and programmes aimed specifically at solving the population's food and nutritional problems.

Production factors include those directly associated with the production of food, as well as the access that the at-risk population has to them. The availability and autonomy of each country's dietary energy supply depend directly on the characteristics of production processes, the degree to which they utilize natural resources, and the extent to which these processes mitigate or aggravate environmental risks.

Finally, biomedical factors take into account the individual's susceptibility to undernutrition, insofar as deficiencies in certain elements limit the capacity to make biological use of the food consumed (regardless of quantity and quality).

[28] Rodrigo Martínez and Andrés Fernández, *Model for analysing the social and economic impact of child undernutrition in Latin America,* Naciones Unidas, CEPAL, Social Development Division, Santiago De Chile, 2007.

[29] Idem.

iii. Consequences of undernutrition

Child undernutrition has long-term negative effects on people's lives[30], most notably in the aspects of health, education, and productivity, quantifiable in costs and expenditures to the public and private sectors. Consequently, these effects exacerbate problems in social integration and increase or intensify poverty. A vicious cycle is perpetuated as vulnerability to undernutrition grows.

Undernutrition may have immediate or evolving impacts throughout a person's lifetime, although individuals who suffered from undernutrition during early years of their life cycle (including intrauterine) are more likely to be undernourished later in life. Health studies have shown that undernutrition leads to increased appearance or intensified severity of specific pathologies, and increases the chance of death during specific stages of the life cycle.[31] The nature and intensity of the impact of undernutrition on pathologies depends on the epidemiological profile of a given country.

In education, undernutrition affects student performance through disease-related weaknesses and results in limited learning capacity associated with deficient cognitive development.[32] This translates into a greater probability of starting school at a later age, repeating grades, dropping out of school and ultimately obtaining a lower level of education.

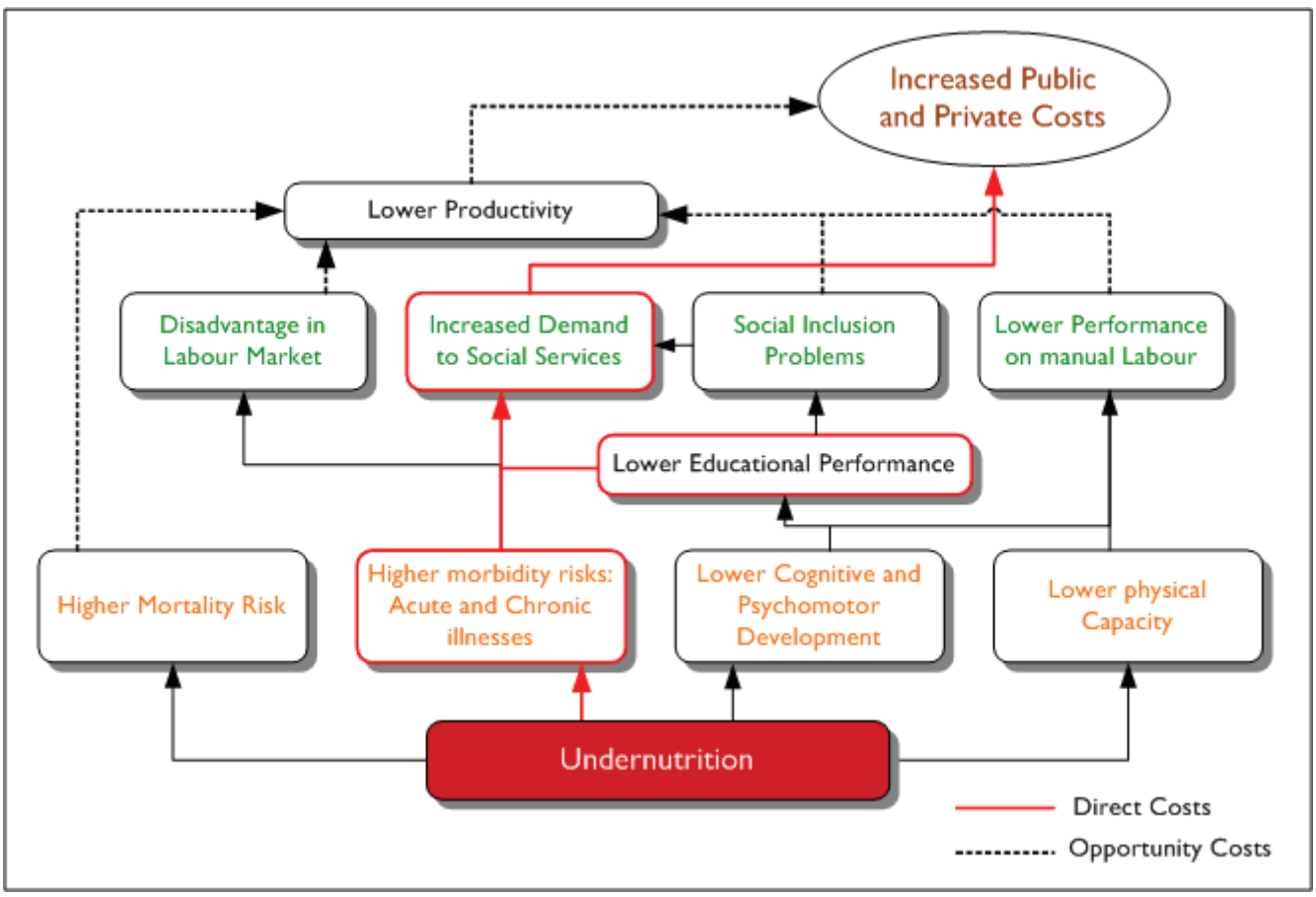
[30]Alderman H., et al., "Long-term consequences of early childhood malnutrition", FCND Discussion Paper No. 168, IFPRI, 2003.

[31]Amy L. Rice et al., "Malnutrition as an underlying cause of childhood deaths associated with infectious diseases in developing countries," *Bulletin of the World Health Organization* 78, No. 2000, 2000.

[32]Melissa C. Daniels and Linda S. Adair, "Growth in young Filipino children predicts schooling trajectories through high school," *The Journal of Nutrition*, March 22, 2004, Jn.nutrition.org.

Later in life, individuals may experience lower physical capacity in manual labour as a result of stunting.[33] Stunting, which is caused by food deprivation and nutrient deficiencies, is established by low height-for-age measurements during childhood. In adulthood, it leads to an overall reduced body mass when compared to the full adult potential.

FIGURE II.2
CONSEQUENCES OF UNDERNUTRITION



Source: Rodrigo Martinez and Andrés Fernández, *Model for analysing the social and economic impact of child undernutrition in Latin America* (see footnote) based on consultations carried out by authors.[34]

Undernutrition and its effects on health and education also translate into heavy economic costs for society at large. Each of the negative impacts in health, education and productivity described above, lead to a social, as well as an economic, loss to the individual or the society.

Thus, the total cost of undernutrition (TC^U) is a function of higher health-care spending (HC^U), inefficiencies in education (EC^U) and lower productivity (PC^U). As a result, to account for the total cost (TC^U), the function can be written as:

$$TC^U = f\,(HC^U, EC^U, PC^U)$$

In the area of health, the high probability resulting from the epidemiological profile of individuals suffering from undernutrition proportionally increases the costs in the health care sector (HSC^U). In aggregate, this is equal to the sum of the interactions between the probability of undernutrition in each age group, the probability that a particular group will suffer from the diseases because of undernutrition, and the costs of treating the pathology (HSC^U) that typically includes diagnosis, treatment and control. To these are added the costs paid by individuals and their families as a result of lost time and quality of life (IHC^U). Thus, to study the variables associated with the health cost (HC^U) the formula is:

$$HC^U = f\,(HSC^U, IHC^U)$$

In education, the reduced attention and learning capacity of those who have suffered from child undernutrition increase costs to the educational system (ESC^U). Repeating one or more grades commensurately increases the demand that the educational

[33]Lawrence J. Haddad and Howarth E. Bouis, "The impact of nutritional status on agricultural productivity: wage evidence from the Philippines," *Oxford Bulletin of Economics and Statistics* 53, No. 1, February 1991, doi:10.1111/j.1468-0084.1991.mp53001004.x.

[34]Idem.

system must meet, with the resulting extra costs in infrastructure, equipment, human resources and educational inputs. In addition, the private costs (incurred by students and their families) derived from the larger quantity of inputs, external educational supplementation and more time devoted to solving or mitigating low performance problems (IEC^U) are added to the above costs. Thus, in the case of the education cost (EC^U), the formula is:

$$EC^U = f\,(ESC^U, IEC^U)$$

The productivity cost associated with undernutrition is equal to the loss in human capital (HK) incurred by a society, stemming from a lower educational level achieved by malnourished individuals (ELC^U), a lower productivity in manual labour experienced by individuals who suffered from stunting (MLC^U) and the loss of productive capacity resulting from a higher number of deaths caused by undernutrition (MMC^U). In the model these costs are reflected as losses in potential productivity (PC^U). Thus:

$$PC^U = f\,(ELC^U, MLC^U, MMC^U)$$

As a result, in order to comprehensively analyse the phenomenon of undernutrition, the model considers its consequences on health, education and productivity by translating them into costs.

iv. Dimensions of analysis

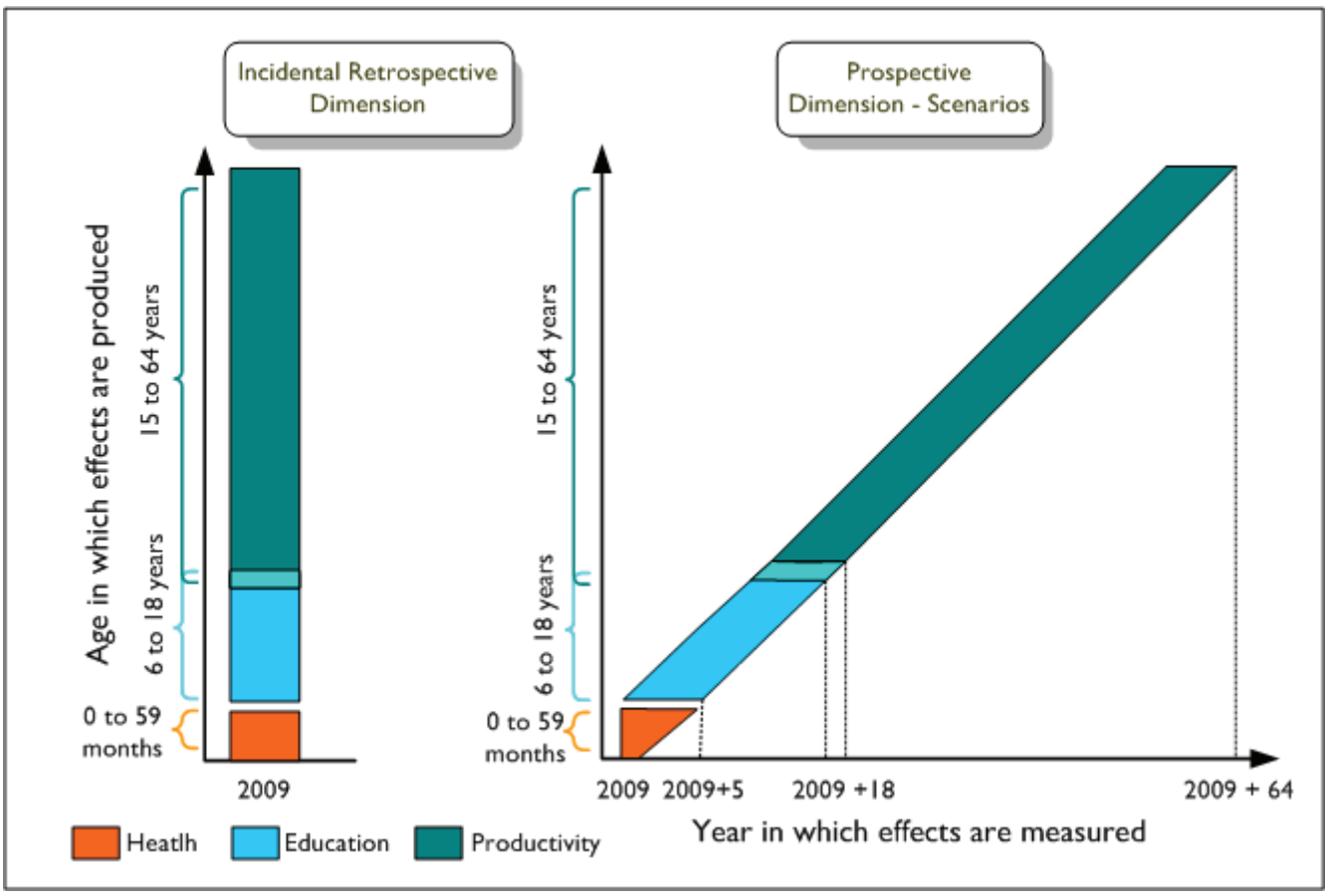
Considering that a country's undernutrition situation and the consequences thereof reflect a specific epidemiological and nutritional transition process, a comprehensive analysis involves estimates of the current situation extrapolated from previous transitional stages as well as estimates of the future to predict potential cost and saving scenarios based on prospective interventions to control or eradicate the problem.

On this basis, a two-dimensional analysis model has been developed to estimate the costs arising from the consequences of child undernutrition in health, education and productivity:

1. ***Incidental retrospective dimension*** focuses on the population in the study year, including mortality cases of those who would have been alive in the study year. The retrospective dimension estimates the nutritional situation of individuals under the age of five to identify the related economic costs in the study year. Thus, it is possible to estimate the health costs of pre-school boys and girls who suffer from undernutrition during the year of analysis, the education costs stemming from the children currently in school who suffered from undernutrition during the first five years of life, and the economic costs due to lost productivity by working-age individuals who were exposed to undernutrition before the age of five.
2. ***Prospective, or potential savings, dimension***. This dimension focuses on children under five in a given year and allows analysis of the present and future losses incurred as a result of medical treatment, repetition of grades in school and lower productivity. Based on this analysis, potential savings derived from actions taken to achieve nutritional objectives can be estimated.

As shown in Figure II.3, the incidental retrospective dimension includes the social and economic consequences of undernutrition in a specific year (for the purposes of this report 2009 was set as the base year) for cohorts that have been affected (0 to 4 years of age for health, 6 to 18 years for education and 15 to 64 years for productivity). The prospective dimension on the other hand, projects the costs and effects of undernutrition recorded in the reference year of the study. These are based on the number of children born during the period selected in the analysis and, with the application of a discount rate, on the present value estimates of future costs to be incurred due to the consequences of undernutrition. The prospective dimension is the basis for establishing scenarios to estimate the economic and social savings of an improved nutritional situation.

FIGURE II.3
DIMENSIONS OF ANALYSIS BY POPULATION AGE AND YEAR WHEN EFFECTS OCCUR



Source: Rodrigo Martinez and Andrés Fernández, *Model for analysing the social and economic impact of child undernutrition in Latin America* (see footnote) based on consultations carried out by authors.[35]

v. Methodological aspects

The analysis focuses on undernutrition during the initial stages of the life cycle and its consequences throughout life. This limits the study to the health of the foetus, the infant and the pre-schooler, i.e. those aged 0 to 59 months.[36] Similarly, the effects on education and productivity are analysed in the other demographic groups, i.e. 6-18 years old and 15-64 years old, respectively.

The population of children suffering from undernutrition was divided into sub-cohorts (0 to 28 days, 1 to 11 months, 12 to 23 months and 24 to 59 months) in order to highlight the specificity of certain effects during each stage of the life cycle.

The study uses undernutrition indicators that are measurable and appropriate to the different stages of an individual's life cycle. For intrauterine undernutrition, low birth weight (LBW) due to intrauterine growth restriction (IUGR, defined as a weight below the tenth percentile for gestational age) is estimated. For the pre-school stage, moderate and severe stunting categories (weight-for-height scores below -2 standard deviations) are used, with reference, where possible, to the World Health Organization (WHO) distribution for comparison purpose.[37]

Estimates of the impacts of undernutrition on health, education and productivity are based on the concept of the relative (or differential) risk run by individuals who suffer from undernutrition during the first stages of life as compared to a healthy child. This is valid both for the incidental-retrospective analysis and for the prospective-savings analysis; however, as its application has specific characteristics in each case, they are detailed separately in this document.

[35] Rodrigo Martínez and Andrés Fernández, *Model for analysing the social and economic impact of child undernutrition in Latin America,* Naciones Unidas, CEPAL, Social Development Division, Santiago De Chile, 2007

[36] In the original design, the idea of analyzing direct information on the nutritional and health situation of pregnant women was considered, but the lack of reliable information on the incidence of undernutrition led to its exclusion from the analysis.

[37] In the estimation of stunting, a complementary analysis is done based on NCHS Standard in order to estimate the relative risk of lower productivity.

To estimate the costs for the incidental retrospective dimension, the values occurring in the year of analysis are totalled based on estimates of differential risks undergone by the different cohorts of the population. In the prospective analysis on the other hand, a future cost flow is estimated and updated (to present value).

The methodological approach presented here considers the most detailed and complete set of causes and effects of child undernutrition. Further, consideration has been made to ensure that certain causes and effects are not overemphasized or double counted. The methodological framework is based on strong research as well as institutional support from international organizations, and has been deemed a strong basis for the purpose of the research described in this report.

Section III: Effects and Costs of Child Undernutrition

III Effects and Costs of Child Undernutrition

Undernutrition is mainly characterized by wasting - a low weight-for-height, stunting - low height-for-age and underweight - low weight-for-age. In early childhood, undernutrition has negative life-long and intergenerational consequences; undernourished children are more likely to require medical care as a result of undernutrition-related diseases and deficiencies. This increases the burden on public social services and health costs incurred by the government and the affected families. Without proper care, underweight and wasting in children results in a higher risk of mortality. During schooling years, stunted children are more likely to repeat grades and drop out of school, reducing thus, their income-earning capability later in life. Furthermore, adults who were stunted as children are less likely to achieve their expected physical and cognitive development, thereby impacting on their productivity.

In addition to identifying the physical, psychological and social effects of undernutrition, the economic costs for the direct consequences of undernutrition have been estimated for 2009. The retrospective dimension of the analysis of education, health and productivity effects is presented below together with costs resulting from undernutrition.

A. Social and economic cost of child undernutrition in the health sector

Undernutrition at an early age predisposes children to higher morbidity and mortality risks. The risk of becoming ill due to undernutrition has been estimated using probability differentials, as described in the methodology. Specifically, the study has examined medical costs associated with treating low birth weight (LBW), underweight, anaemia, acute respiratory infections (ARI), acute diarrheal syndrome (ADS) and fever/malaria associated with undernutrition in children under the age of five.

i. Effects on morbidity

Undernourished children are more susceptible to recurring illness[38]. Based on the differential probability analysis undertaken with DHS data [39] in Uganda, underweight children are more affected by diarrhoea (18% more of cases) and fever (10% more) than healthy children. Acute respiratory infections are also more common in underweight children, particularly during the first 12 months of life at an incremental rate of 7%. Despite a higher incidence of anaemia in underweight children aged 24 to 59 months, the risk of children under five years of age having anaemia is high, regardless of their nutritional status,

The study estimated that in 2009 in Uganda there were almost 1.6 million more episodes of illness related to diseases that could be associated to being underweight. The highest occurrence of episodes was found in ADS with almost 300,000 more episodes in underweight children, followed by fever with over 120,000 annual episodes.

In addition, pathologies related to calorie and protein deficiencies and low birth weight associated to Intrauterine Growth Restriction (IUGR) totalled more than 1 million episodes in 2009, as indicated in Table 4. Acute and chronic illness due to diseases such as ADS, anaemia, fever and ARI on the other hand, represents almost half a million episodes annually.

[38] Ramachandran P. & Gopalan H., *"Undernutrition &risk of infections in preschool children"*, Indian J Med Res 130, November 2009, pp. 579-583.
[39] *Uganda Demographic and Health Survey 2011,* Uganda Bureau of Statistics (UBOS) and ICF International Inc., . Kampala, Uganda: UBOS and Calverton, Maryland: ICF International Inc. 2012.

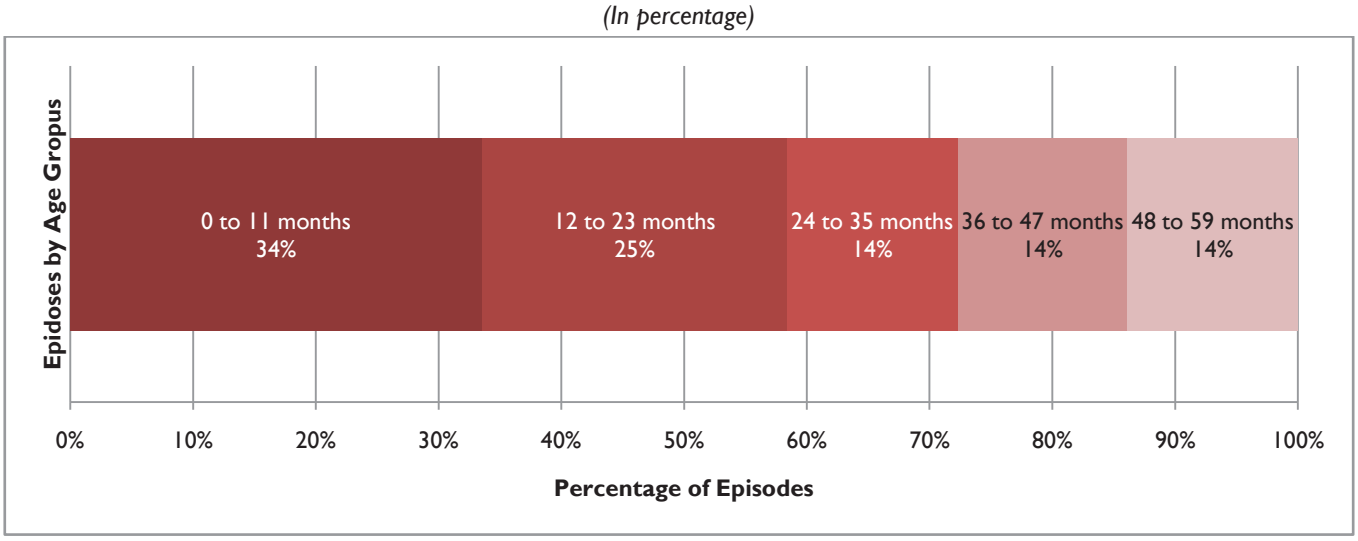
TABLE III.1
UNDER-FIVE CHILD MORBIDITY ASSOCIATED WITH UNDERWEIGHT, BY PATHOLOGY, 2009

Pathology	Number of Episodes	Proportion of Episodes
Anaemia	55,923	11%
ADS	289,994	59%
ARI	27,462	6%
Fever/Malaria	121,943	25%
Sub-Total	495,322	
IUGR	82,635	8%
Underweight	975,450	92%
Sub-Total	1,058,084	
Total	**1,553,407**	

Source: Model estimations based on DHS 2006-2011, and demographic information from UBOS.

Most episodes of incremental illness associated to undernutrition happen before the first year of life. This is the period of the first thousand days of life, where children are most threatened due to age-specific vulnerabilities. In Uganda 34% of all incremental episodes occur in children under 12 months, with 20% of those episodes being associated to children born with low birth weight. This seems to indicate that preventing undernutrition and focusing on the mothers' health and nutritional education might generate important savings by reducing the incidence of episodes.

FIGURE III.1.
NUMBER OF INCREMENTAL EPISODES DUE TO UNDERNUTRITION BY AGE GROUP
(In percentage)



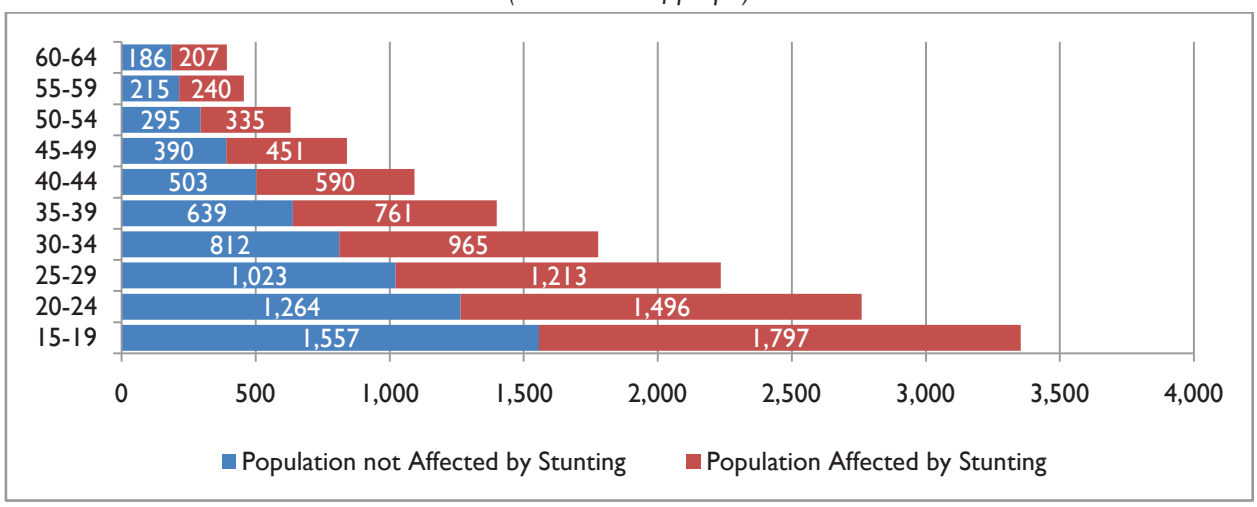
Source: Models estimations based on DHS 2006-2011, and demographic information from UBOS.

The number of episodes is estimated based on the differential probability that a child has of becoming ill due to undernutrition. To estimate the costs of the pathologies, data from epidemiological follow-up studies and official health statistics on Uganda were reviewed. In addition, interviews with national specialists provided further information. A complete list of assumptions and sources has been annexed to this report.

ii. Stunting levels of the working age population

Undernutrition leads to stunting in children, which can impact on their productivity at later stages in life[40]. Although Uganda has made significant progress in reducing the levels of stunted children, a large proportion of the adult population is currently living with the life-long consequences of childhood stunting rates that had reached almost half of the population in the late 1980s.[41]As illustrated in Figure III.2 below, this analysis estimates that over 8 million adults in the working-age population suffered from growth restriction before reaching the age of five. Currently this represents more than 54% of the population aged 15-64, who are in a disadvantaged position as compared to those who had healthy childhoods.[42]

FIGURE III.2
POPULATION AFFECTED BY CHILDHOOD STUNTING, BY AGE
(In thousands of people)



Source: Model estimations based on demographic information and WHO/NCHS/DHS nutritional surveys.

According to the information from the latest Household Income and Expenditure Survey most of the working-age population in Uganda is involved in manual activities[43]. The physical consequences of childhood stunting have affected these adults by reducing their productive capacity in manual intensive activities, as compared to people who were not affected by growth retardation as children. Additionally, the proportion of the population involved in non-manual activities, who was affected by undernutrition, tends to have a lower educational level and hence, a lower productive level than those who were nourished as children. The effect of these stunting levels on the productive capacity of the country will be analysed in the productivity section of this report.

iii. Effects on mortality

Child undernutrition can lead to increased cases of mortality most often associated with incidences of diarrhoea, pneumonia and malaria.[44.] Nevertheless, when the cause of death is determined, it is rarely attributed to the nutritional deficit of the child but often to the illness that the child manifested. Given this limitation in attribution, the model utilizes relative risk factors[45]to estimate the risk of increased child mortality as a result of child undernutrition. Using these factors, abridged life tables[46] were used to estimate the incidence of higher mortality risk due to undernutrition.

The model estimates that in Uganda nearly one out of every seven reported deaths of children is associated with undernutrition. As indicated in Table 5 below, in the last 5 years alone, it is estimated that 110,000 deaths, representing 15%, occurred in children whose diminished nutritional condition increased their mortality risk. Thus, it is evident that undernutrition significantly exacerbates the rates of death among children and limits the country's capacity to achieve the MDGs, especially the goal to reduce child mortality.

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[40]K.G. Dewey and K. Begum, *Long-term consequences of stunting in early life*, Maternal and Child Nutrition, 7, Suppl. 3, 2011, , pp. 5–18
[41]Emmanuel Kaijuka et al., *Uganda Demographic and Health Survey 1988/1989*, Report, Measure DHS,Entebbe, Ministry of Health, 1989,.

[42]Model estimations based on demographic information and WHO/NCHS/DHS nutritional surveys.
[43]*2010 Statistical Abstract*, Report, Ugandan Bureau of Statistics, http://www.ubos.org.

[44]Robert E. Black et al., "Maternal and child undernutrition: global and regional exposures and health consequences," *The Lancet* 371, No. 9608, 2008, doi:10.1016/S0140-6736(07)61690-0.
[45]*Ibid.*
[46] Data provided by the UN Population Division, http://www.un.org/esa/population/unpop.htm.

TABLE III.2
IMPACT OF UNDERNUTRITION ON CHILD MORTALITY, ADJUSTED BY SURVIVAL RATE, 1945-2009
(In number of mortalities)

Period	Number of child mortalities associated to undernutrition
1945-1994	567,048
1995-2004	207,935
2005-2009	110,220
Total	885,203

Source: ECA on the basis of life tables provided by UN Population Division[47]

These mortality rates, witnessed over the years, have an impact on national productivity. The model estimated that an equivalent of 3.4% of the current workforce was lost due to the impact of undernutrition on child mortality between 1945 to 2009. This represents 567,048 people who would have currently been 15 to 64 years old and part of the working-age population of the country. In effect, besides this problematic reality, the findings suggest that undernutrition reduces the productivity and the development potential of the country.

iv. Estimation of public and private health costs

The treatment of undernutrition and related illness is a critical recurrent cost for the health system. Treating a severely underweight child for example, requires a comprehensive protocol[48] that is often most costly than the monetary value and effort needed to prevent undernutrition, especially when other diseases are present in parallel. The economic cost of each episode is often increased by inefficiencies when such cases are treated without proper guidance from a health-care professional or due to lack of access to proper health services. These costs generate a significant important burden not just to the public sector but to society as a whole.

It is estimated that 1.6 million clinical episodes recorded in Uganda in 2009 were associated to undernutrition. These generated an estimated cost of more than 525 billion UGX, as indicated in Table III.3 below.[49] Most of the incurred costs were associated to the protocol requiring bringing an underweight child back to a proper nutritional status, which often involves therapeutic feeding[50]. An important element to highlight is the particular costs generated by the treatment of low birth weight children. These cases represented 5% of all the episodes but generated 26% of the total cost, making it the highest per capita element analysed. This is due to the special management protocol applied to LBW children, implying hospitalization and often requiring time in intensive care[51].

TABLE III.3
HEALTH COST OF UNDERNUTRITION-RELATED PATHOLOGIES, 2009
(In millions of UGX)

Pathology	Cost	% of episodes	% of Cost
LBW/IUGR	134,342	5%	26%
Anaemia	1,313	4%	0%
ADS	4,778	19%	1%
ARI	1,971	2%	0%
Underweight	369,477	63%	70%
Fever/Malaria	13,955	8%	3%
Total Cost	**525,835**	100%	100%

Source: Estimations based on data provided by the National Implementation Team, DHS 2006/2011, and cost analysis carried-out by NIT.

A large proportion of costs related to undernutrition are met by the families themselves, as often these children are not provided with proper health care. Based on the information collected by the NIT, the model estimated that only about 15% of

[47]"World Population Prospects, the 2010 Revision," World Population Prospects, the 2010 Revision, accessed March 13, 2013, http://esa.un.org/wpp/Model-Life-Tables/download-page.html.

[48]WHO, *Management of severe malnutrition: a manual for physicians and other senior health workers* ISBN 92 4 154511 9, NLM Classification: WD 101, 1999.
[49]Estimations based on data provided by the National Implementation Team, DHS 2006-2011, and cost analysis carried out by NIT.
[50]WHO, *Management of severe malnutrition: a manual for physicians and other senior health workers*, ISBN 92 4 154511 9, NLM Classification: WD 101, 1999.
[51]WHO, *Integrated management of pregnancy and childbirth*, ISBN 92 4 159084 X. 2009

underweight children under the age of five are attended at the health facilities. However, this number increases to 25% when the child presents an additional pathology such as diarrhoea, anaemia, fever/malaria or acute respiratory infection. This may indicate that caretakers may not react quickly enough to loss in weight, hence increasing the risk for health complications.

The discrepancy in the distribution of episodes that do not receive proper health care is also reflected in the distribution of the health costs. Table III.4 summarizes the institutional (Public Health System) incurred costs and the cost incurred by families (caretakers) during the treatment of pathologies associated to undernutrition. In Uganda, it is estimated that families bear around 87% of the health costs associated to undernutrition, representing 456 billion UGX. On the other hand, 69.7 billion UGX, corresponding to 13% of the total costs were attributed to the health system.

TABLE III.4
DISTRIBUTION OF HEALTH COST OF UNDERWEIGHT, 2009
(In millions of UGX)

Pathology	Cost to Families	Cost to Public Health System	Total Cost
Underweight	344,447	25,029	369,477
LBW/IUGR	94,802	39,540	134,342
Fever/Malaria	9,976	3,978	13,955
ADS	4,686	92	4,778
Anaemia	1,189	124	1,313
ARI	1,007	964	1,971
Total Cost	**456,108**	**69,728**	**525,835**
Distribution of Cost	87%	13%	

Source: Estimations based of data provided by DHS 2006/2011, and data collected by NIT. For a summary of assumptions refer to Annex 2.

Although the families of undernourished children are incurring most of the health costs related to undernutrition, the burden of this phenomenon is still an important expenditure component in the public sector. In 2009-2010 the annual estimated cost related to undernutrition was equivalent to 11% of the total budget allocated to health[52]. As a whole, the economic impact of undernutrition in health-related aspects was equivalent to 1.6% of the GDP of that year.

[52] WHO, National Health Accounts, Uganda.

B. Social and economic cost of child undernutrition in education

There is no single cause for repetition and dropout; however, there is substantive research[53] that shows that students who were stunted before the age of five are more likely to underperform in school. As a result, undernourished children are faced with the challenge of competing favourably in school due to their lower cognitive and physical capacities than children who were able to stay healthy in the early stages of life.

The number of repetition and dropout cases considered in this section of the report result from applying a differential risk factor associated to stunted children, as well as to the official government information on grade repetition and dropouts in the educational system in 2009. The cost estimations are based on the average cost of a child to attend primary and secondary school in Uganda in 2009 provided by the Ministry of Education, as well as estimations of costs incurred by families to support child schooling.

i. Effects on repetition

Children who suffered from undernutrition before the age of five are more likely to repeat grades, compared to those were not afflicted by undernutrition[54]. In 1997 with the launch of the universal primary education, Uganda rolled out a non-repetition policy, in which most children would get an automatic promotion to the next grade. Nevertheless, the policy also includes exceptions, in which a child should be held back for one additional year on unsatisfactory performance grounds (due to illness, for example). Currently, there is an estimated 5.8 million school-age children who are stunted, representing 51% of the total population aged between 6 and 18 years in the country.

Based on official information provided by the Ministry of Education, the effective average repetition rate for public schools in the country was estimated at 10.7%, with over 1.8 million children having repeated grades in 2009. Considering the higher risk of undernourished children to repeat grades, the model distributed the stunted and non-stunted school aged population and calculated the specific repetition rates for both groups. It is estimated that the repetition rate for stunted children was higher than the national average (12.2%), while the repetition rate for non-stunted children was estimated at 9.1%, establishing a differential risk of 3.2% for stunted children to repeat.

FIGURE III.3
REPETITION RATES IN PRIMARY EDUCATION BY NUTRITIONAL STATUS, 2009
(In percentages)

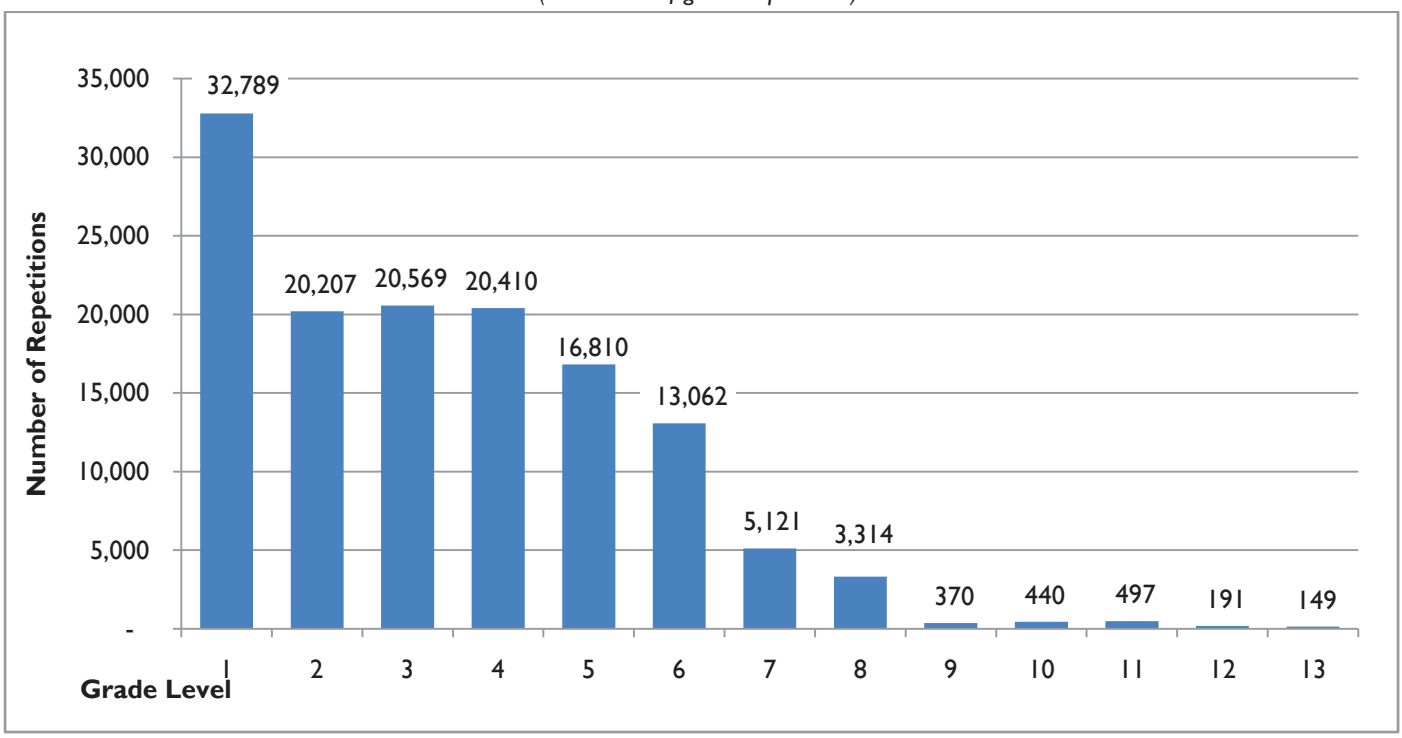
Source: Estimations based on data from EMIS (Ministry of Education – Education Management Information System for 2009 provided by NIT (National Implementation Team).

[53] Melissa C. Daniels and Linda S. Adair, "Growth in young Filipino children predicts schooling trajectories through high school," *The Journal of Nutrition*, March 22, 2004, pp. 1439–1446, accessed September 11, 2012, Jn.nutrition.org.
[54] *Ibid.*

As a result, from the 1.8 million cases of grade repetition reported by the Ministry of Education in 2009, 133,931 (7.3% of all cases) are estimated to be repetition cases induced by stunting. These children are currently generating an incremental cost to the education system, as they require twice as many resources having to repeat the year. In addition, the caretakers also have to cater to their educational cost for an extra year.

Most of these grade repetitions happen during the first four years of schooling, particularly in grade 1, in which the highest rate of repetition is reported. There are far fewer children who repeat grades during secondary school, largely due to the fact that many stunted children would have dropped out of school before reaching secondary education.

FIGURE III.4
GRADE REPETITION OF UNDERWEIGHT CHILDREN, BY GRADE, 2009
(In number of grade repetitions)



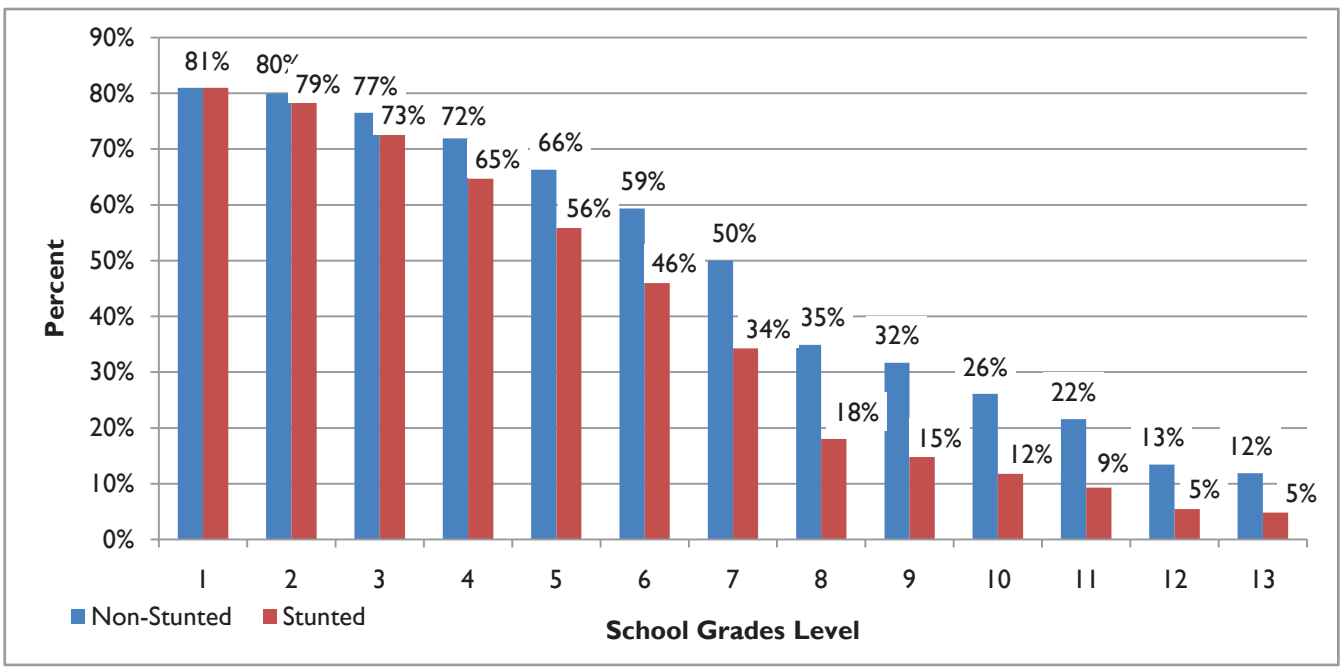
Source: Estimations based on data from EMIS Ministry of Education – Education Management Information System for 2009 provided by NIT.

ii. Effects on retention

The cost associated with school dropouts is derived from the differential in achievements between stunted and non-stunted working-age population. These costs are reflected in the productivity losses experienced by individuals searching for opportunities in the labour market. As such, the impact is not evident in the school-age population but in the working-age population (WAP), particularly in non-manual activities. Hence, in order to assess the social and economic costs for 2009, the analysis needs to focus on the differential in schooling levels achieved by the population who suffered from stunting as children and the education levels achieved by the non-stunted population.

Among the population who suffered from child stunting, significantly fewer reached secondary school. According to the available data and relative risks of stunting on education, it can be estimated that 50% of non-stunted population completed primary school, compared to only 34% of stunted children. Similar trends are observed in secondary school, where an estimated 12% of non-stunted children and less than 5% of stunted children completed secondary school. . Figure III.5 shows the estimated grade achievement based on nutritional status. These differences in education become notable when considering gaps in labour and income opportunities, specifically for non-manual labour.

FIGURE III.5
GRADE ACHIEVEMENT BY NUTRITIONAL STATUS, 2009
(In percentages)



Source: Model estimations based from Uganda Bureau of Statistics (UBOS) provided by NIT (National Implementation Team).

iii. Estimation of public and private education costs

Repetition in schooling years has direct cost implications to families and the school system. Consequently in 2009, the 133,931 students, who repeated grades following their state of being undernourished, incurred a cost of 19.7 billion UGX. The largest proportion of repetitions occurred in primary school, where the cost burden mostly falls on the public education system. However, unit costs are significantly higher for repetitions in secondary school. The following chart summarizes the public and private education costs associated with stunting.

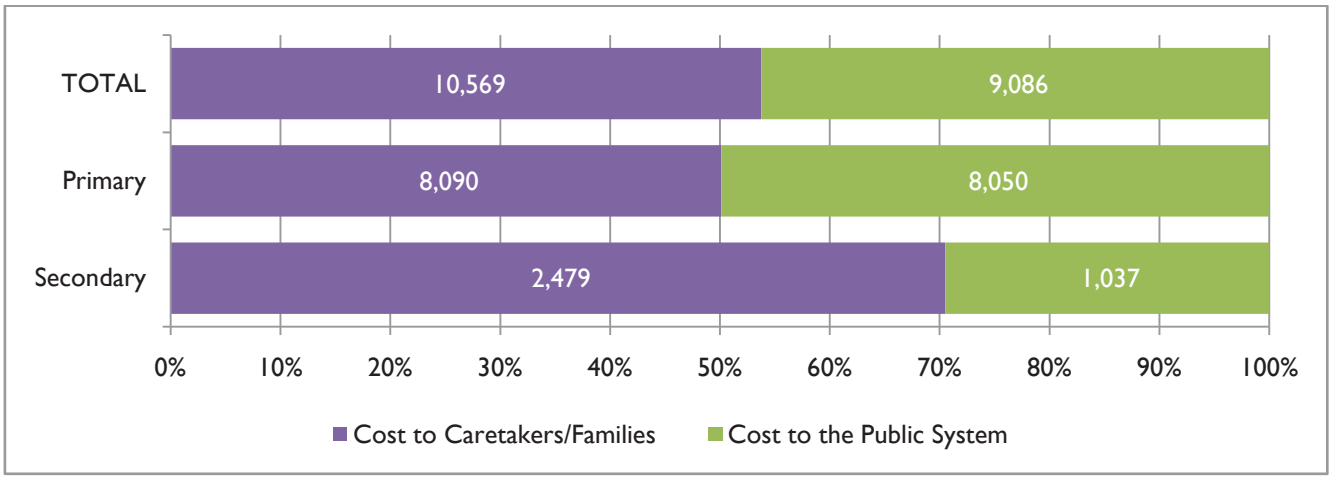
TABLE III.5
COSTS OF GRADE REPETITION ASSOCIATED TO STUNTED CHILDREN, 2009

	Primary	Secondary	Total
Public Costs per student (UGX)	62,415	208,952	
Private Costs per student (UGX)	62,731	499,616	
Number of repetitions	128,970	4,961	133,931
Total Public Costs (millions of UGX)	8,050	1,037	9,086
Total Private Costs (millions of UGX)	8,090	2,479	10,569
Total (millions of UGX)			19,655
% Social expenditure on education			1.8%

Source: Estimations based on official education statistics from EMIS Ministry of Education – Education Management Information System for 2009 provided by NIT (National Implementation Team).

As in the case of health, the social cost of undernutrition in education is shared between the public sector and the families. Of the overall costs, a total of 10.5 billion UGX (46%) was covered by the caretakers, while 9.1 billion UGX (54%) was borne by the public education system. Nevertheless, the distribution of this cost varies depending on whether the child repeated grades at primary or secondary level. In primary education, the families cover 50% of the associated costs of repeating a year, whereas in secondary education the burden on the families is as high as 71%. This could also be a contributing factor to the higher dropout rates found in secondary education.

FIGURE III.6
DISTRIBUTION OF COSTS FOR REPETITIONS, PRIMARY EDUCATION
(In millions of UGX)



Source: Estimations based on data provided by Ministry of Education (2009).

C. The social and economic cost of child undernutrition in productivity

Child undernutrition affects human capital and productivity in several dimensions[55]. Children who suffered from undernutrition have lower expected levels of schooling achievement than healthy children. The low education levels attained often make them less qualified for work, thus reducing their income-earning potential for non-manual work. Adults who suffered from stunting as children tend to have less lean body mass and are therefore more likely to be less productive in manual intensive activities than those who were never affected by growth retardation. Moreover, the population lost due to child mortality hinders economic growth, as they could have been healthy productive members of the society.

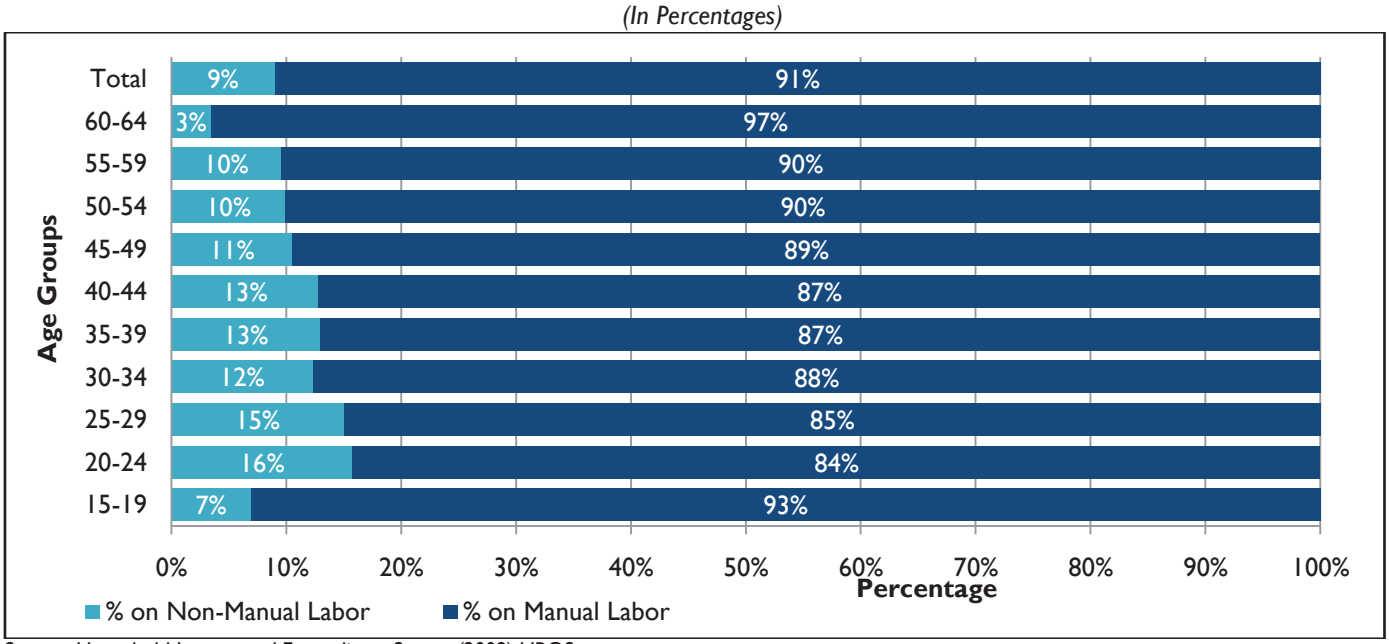
The estimation of the population whose labour productivity is affected as a consequence of child undernutrition is based on historical nutritional information, in-country demographic projections and incomes reported in the Uganda National Household Survey 2009-2010. The workforce lost due to higher mortality risk of undernourished children is based on adjusted mortality rates estimated in the health section of this report.

The cost estimates for labour productivity are a result of the differential income associated to lower schooling in non-manual activities and the lower productivity associated to stunted children in manual intensive work, such as agriculture. The opportunity cost of productivity due to mortality is based on the expected income that a healthy person would have been earning, had he/she been part of the workforce in 2009.

i. Losses from non-manual activities due to reduced schooling

The distribution of the working population in the labour market is an important contextual element in determining the impact of undernutrition on national productivity. Although the proportion of the population engaged in non-manual activities is relatively small, the average income of this population is higher than that of the population working in manual activities. As shown in Figure III.7, the trend of non-manual labour seems to be higher in the younger group (20 to 29 years of age) and manual activities seems to be more predominant among 30 to 59 year olds. In 2009, 1.7 million of working-age people were involved in non-manual activities.

FIGURE III.7
MANUAL AND NON-MANUAL LABOUR DISTRIBUTION, BY AGE, 2009
(In Percentages)



Source: Household Income and Expenditure Survey (2009) UBOS

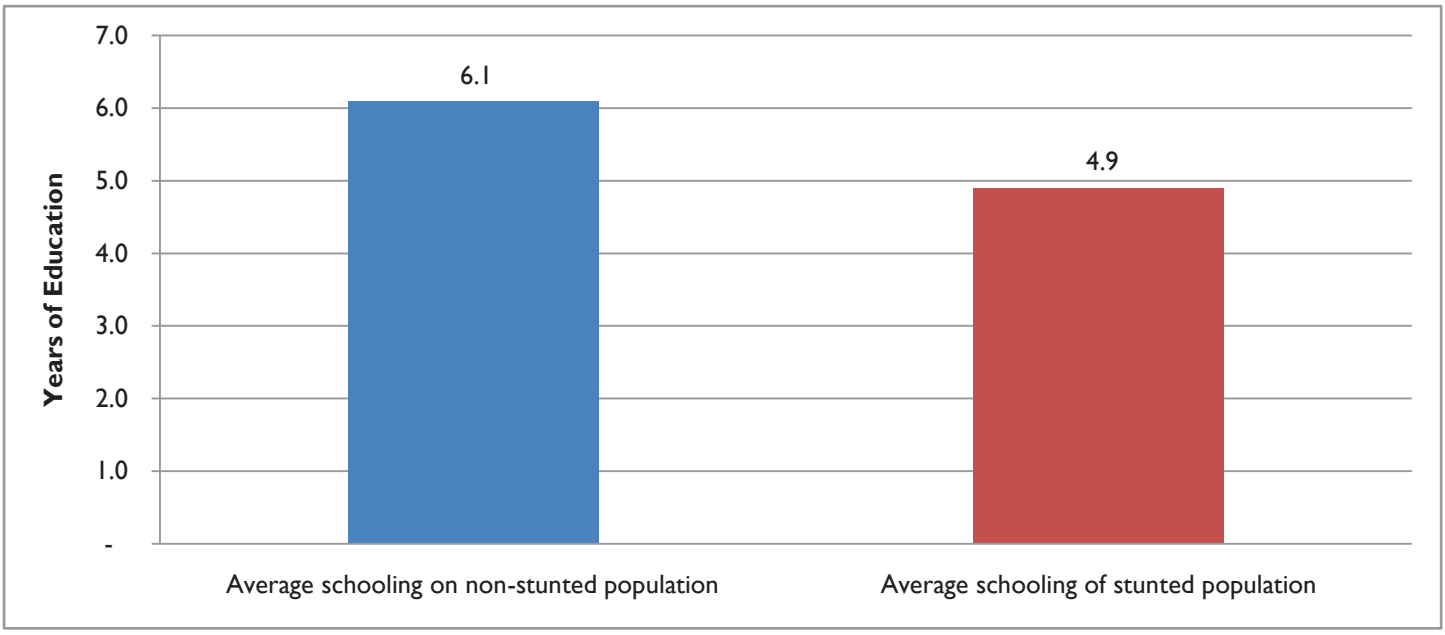
As described in the education section of this report, the stunted population completes on average fewer years of schooling than students who were adequately nourished as children. This situation affects mostly people who are engaged in non-manual activities, in which a higher academic education leads to improved income. In the case of Uganda, 9% of the working-age

[55]Alderman H., et al.,*Long-term consequences of early childhood malnutrition*, FCND Discussion Paper No. 168, IFPRI, 2003.

population is engaged in non-manual activities[56]. The average schooling of the non-stunted population is estimated at 6.1 years, while people who suffered from childhood stunting achieved only 4.9 years.

It is important to note that over time there has been an improvement in the average number of years people remained in the education system. Whereas the cohort of 60-64 years schooled on average 3.5 years, the cohort aged 20-24 recorded an average of 6.5 years. Figure III.8 below demonstrates the average schooling years for stunted and non-stunted population in Uganda as of 2009-2010.

FIGURE III.8
AVERAGE SCHOOLING YEARS FOR STUNTED AND NON-STUNTED POPULATION
(In Years of Education)



Source: Model estimations based on UNHS 2009/2010 UBOS and DHS 2006/2011.

The lower educational achievement of the stunted population has an impact on the expected level of income a person would earn as an adult. As indicated in Table III.6, the model estimates that 945,554 people engaged in non-manual activities suffered from childhood stunting. This represents 6.3% of the country's labour force that is currently less productive due to lower schooling levels associated with stunting.

The estimated annual losses in productivity for this group are 241 billion UGX, equivalent to 0.7% of the GDP in 2009.

TABLE III.6
REDUCED INCOME IN NON-MANUAL INTENSIVE ACTIVITIES DUE TO STUNTING, 2009

Age in 2009	Population working in non-manual sectors who were stunted as children *(In thousands of people)*	Income Losses in non-manual labour *(In millions of UGX)*
15-24	360	51,549
25-34	301	60,246
35-44	174	59,834
45-54	81	56,046
55-64	30	13,389
Total	**945.6**	**241,064**
% GDP		**0.7%**

Source: Model estimations based on income UNHS 2009/2010 UBOS and DHS 2006/2011.

[56] *Uganda National Household Survey 2009-2010*, Report, Ugandan Bureau of Statistics, 2010, http://www.ubos.org/UNHS0910/unhs200910.pdf.

ii. Losses in manual intensive activities

Manual intensive activities are mainly observed in the agricultural, forestry and fishing subsectors, employing more than 70% of the population. In this type of activities, people who were stunted as children are less physically capable than those who did not suffer from growth retardation. As such, they are expected to be less productive[57].

The model estimates that 13.1 million Ugandans are engaged in manual activities, of which 7.1 million were stunted as children. This represented annual losses surpassing 417 billion UGX, equivalent to 1.28% of GDP, in potential income lost due to lower productivity (Table III.7).

TABLE III.7
LOSSES IN POTENTIAL PRODUCTIVITY MANUAL INTENSIVE ACTIVITIES DUE TO STUNTING, 2009

Age in 2009	Stunted Population working in manual labour (in Thousands)	Loss in productivity due to stunting (In millions of UGX)
15-24	2,934	140,094
25-34	1,877	133,737
35-44	1,177	72,160
45-54	705	55,700
55-64	417	15,241
Total	**7,110**	**416,932**
% GDP		**1.28%**

Source: Estimations based on income UNHS 2009-2010 UBOS and WHO/NCHS database information

iii. Opportunity cost due to higher mortality of undernourished children

As indicated in the health section of this report, there is an increased risk of child mortality associated to undernutrition. The model estimates that the 567,048 people of working-age population who could have been part of the economy in 2009 could have increased national productivity by over 943 million working hours.

Considering the productive levels of the population by their age and sector of labour, the model estimated that in 2009 the economic losses (measured by working hours lost due to undernutrition-related child mortality) amounted to 656 billion UGX, which represented 2% of the country's GDP.

TABLE III.8
PRODUCTIVITY LOSSES DUE TO INCREMENTAL CHILD MORTALITY
(In millions)

Age in 2009	Working hours lost due to higher mortality of underweight children *(in millions of Hours)*	Loss in productivity *(in millions of UGX)*
15-24	298	163,984
25-34	236	180,188
35-44	175	127,031
45-54	125	126,985
55-64	108	58,416
Total	943	656,604
% GDP		2.0%

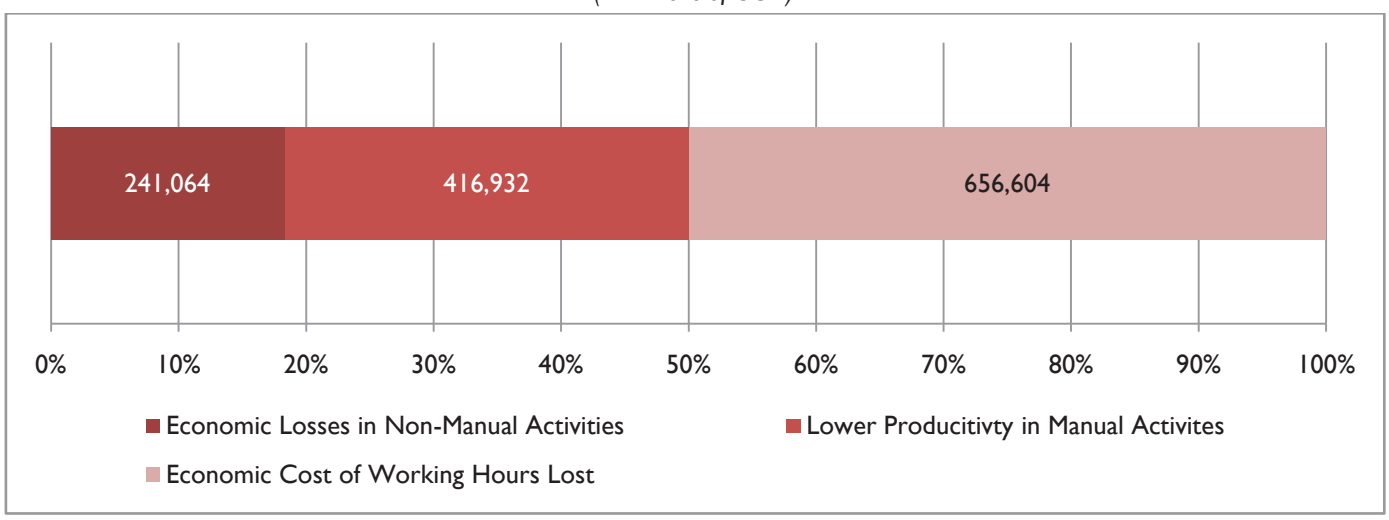
Source: Models estimations based on UNHS and DHS 2006-2011.

[57] Lawrence J. Haddad and Howarth E. Bouis, "The impact of nutritional status on agricultural productivity: wage evidence from the Philippines," *Oxford Bulletin of Economics and Statistics* 53, No. 1, February 1991, doi:10.1111/j.1468-0084.1991.mp53001004.x.

iv. Overall productivity losses

The total losses in productivity for 2009 are estimated at approximately 1.2 trillion UGX, which is equivalent to 3.91% of Uganda's GDP. As presented in Figure III.9, the largest share of productivity loss is due to the working hours lost from individuals who died because of undernutrition. Reduced productivity in manual activities represents 29% of the total loss, as there is a large proportion of the population in Uganda engaged in manual activities. For non-manual activities, the loss seems relatively low, although the per capita loses in this sector are higher than the losses in manual activities.

FIGURE III.9
DISTRIBUTION OF LOSSES IN PRODUCTIVITY, BY SECTOR, 2009
(In millions of UGX)



Source: Model estimations

D. Summary of effects and costs

The developed methodology allowed the study to analyse the impact of child undernutrition in different stages of the life cycle, without generating overlaps. As a result, the individual sectoral costs can be aggregated to establish a total social and economic cost of child undernutrition.

For Uganda, the total losses associated with undernutrition are estimated at 1.9 trillion UGX, or $US899 million for the year 2009. These losses are equivalent to 5.7% of GDP of that year. The highest element in these costs relates to the lost working hours due to mortality associated to undernutrition. Nevertheless, the costs incurred in the health sector also constitute an important element of analysis, representing nearly 30% of the total cost.

Due to the multi-causal phenomenon of grade repetition, the direct costs in education tend to be the lowest of the 3 sectors. Nevertheless, the potential gains in productivity for maintaining children in school are currently 13% of the total cost, which still indicates an important productivity gain to be made from investments in school retention mechanisms.

TABLE III.9
SUMMARY OF COSTS OF CHILD UNDERNUTRITION, 2009
(In millions)

	Episodes	Cost in billions of UGX	Cost in millions of US dollars	Percentage of GDP
Heath Costs				
LBW and Underweight	1,058,084	504	243.5	
Increased Morbidity	495,322	22	10.6	
Total for Health	1,553,407	526	254.1	1.6%
Education Cost				
Increased Repetition - Primary	128,970	16	7.8	
Increased Repetition - Secondary	4,961	4	1.7	
Total for Education	133,931	20	9.5	0.05%
Productivity Costs				
Non-Manual Activities	945,554	241	116.5	
Manual Activities	7,110,178	417	201.5	
Lost Working Hours	567,048	657	317.3	
Total for Productivity	8,622,781	1,315	635.4	3.95%
TOTAL COSTS FOR UGANDA		**1,860**	**899**	**5.6%**

Source: Model compilation.

Section IV: Analysis of Scenarios

IV Analysis of Scenarios

The previous chapter showed the social and economic costs that affected Uganda in 2009 due to high historical trends of child undernutrition. Most of these costs are already cemented in the society and policies must be put in place to improve the lives of those already affected by childhood undernutrition. Nevertheless, there is still room to prevent these costs in the future. Currently, one out of every three children under the age of five in Uganda is stunted.

This section analyses the impact that a reduction in child undernutrition could have on the socio-economic context of the country. The results presented in this section project the additional costs to the health and education sectors as well as losses in productivity that Ugandan children would bear in the future. They also indicate potential savings to be achieved. This is a call for action to take preventive measures and reduce the number of undernourished children to avoid large future costs to the society.

The model generates a baseline that allows development of various scenarios based on nutritional goals established in each country using the prospective dimension. The generated outcomes can be used to advocate for increased investments in proven nutritional interventions. These scenarios are constructed based on the estimated net present value of the costs of children born in each year between 2009 and 2025. The methodology follows each group of children and, based on each scenario, estimates a progressive path towards achieving the set nutritional goals.

The scenarios developed for this report are as follows:

1. **Baseline: The Cost of Inaction. Progress in reduction of stunting and underweight child stops.**

   For the baseline, the progress of reduction of the prevalence of undernutrition stops at the levels achieved in 2009. It also assumes that the population growth would maintain the pace reported in the year of the analysis, hence increasing the number of undernourished children and the estimated cost. As this scenario is highly unlikely, its main purpose is to establish a baseline, to which any improvements in the nutritional situation are compared in order to determine the potential savings in economic costs.

2. **Scenario #1: Cutting by half the prevalence of child undernutrition by 2025.**

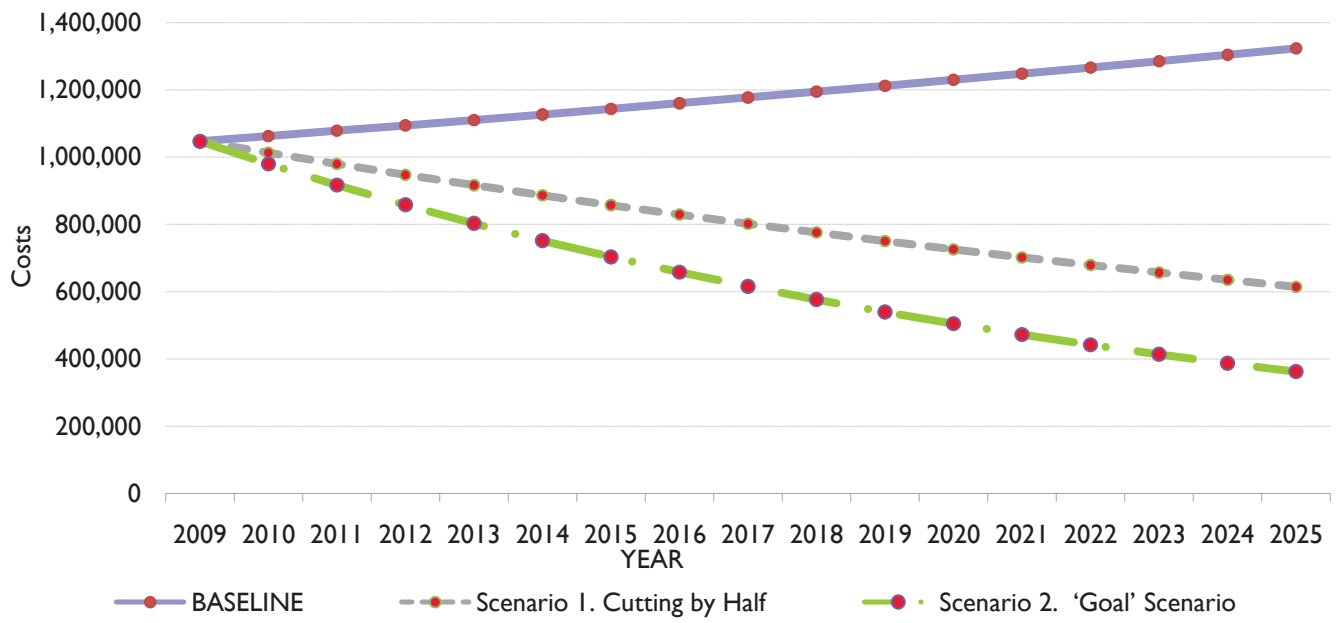
   In this scenario, the prevalence of underweight and stunted children would be reduced to half of the 2009 values corresponding to the reference year. In the case of Uganda this would mean a constant reduction of 1.11% points annually in the stunting rate from 35.5% (estimate for 2009) to 17.8% in 2025. With the right combination of proven interventions, this scenario would be achievable, as the average rate of reduction for stunting between 2001 and 2011 was estimated at 1.14%, which is higher than the progress rate required in achieving this scenario. Nevertheless, for the period 2006-2011, a minor slowdown in the reduction rate (1.06%) was registered, which appears to indicate that stronger investments are required to continue the downward trend.

3. **Scenario #2: The 'Goal' Scenario. Reduce stunting to 10% and underweight children to 5% by 2025.**

   In this scenario, the prevalence of stunted children would be reduced to 10% and the prevalence of underweight children under the age of five, to 5%. This Goal Scenario, would require a true call for action at country level and efficient multisectoral response. The progress rate required to reach this scenario would be 1.6% annual reduction for a period of 16 years, from 2009 to 2025.

As shown in Figure IV.1, the progressive reduction of child undernutrition generates a similar reduction in the costs associated to it. The distances between the trend lines would indicate the savings that would be achieved in each scenario.

FIGURE IV.1
TRENDS OF ESTIMATED COSTS OF CHILD UNDERNUTRITION, 2009-2025
(In millions of UGX)



In the baseline, where the progress of reduction of child undernutrition would stop at the levels of 2009, the total cost would increase by 28%, from 1 to 1.4 trillion schillings, during the period leading to 2025. Nevertheless, in the Scenario #1, in which a reduction by half of the current prevalence is achieved, the total cost would reduce by 41% to 628 billion UGX. In the case of the Goal Scenario on the other hand, there would be a 65% reduction in the estimated total costs, amounting to 368 UGX.

TABLE IV.1
ESTIMATED TOTAL COSTS OF CHILD UNDERNUTRITION, BY SCENARIO, 2009
(In millions of UGX)[a/]

	2009	Scenarios for the Year 2025		
		Baseline	S1. Cutting by Half	S2. Goal Scenario
Heath Costs				
Increased Morbidity	233,887	386,552	127,213	43,102
Education Cost				
Increased Grade Repetition	5,258	8,690	4,287	2,398
Productivity Costs				
Lower Productivity in Non-Manual Activities	99,666	164,721	62,977	32,388
Lower Productivity in Manual Activities	118,202	195,355	97,678	55,030
Lower Productivity due to Mortality	604,481	604,481	335,566	235,092
Total Costs	**1,061,494**	**1,359,800**	**627,720**	**368,011**

Source: Model estimations
[a/] All values in net present values at an 8% social discount rate

The potential economic benefits of reducing undernutrition are a key element in making a case for nutrition investments. The reduction in clinical cases in the health system, lowered grade repetition and improved educational performance as well as physical capacity are elements that contribute directly to the national productivity.

As presented in Table IV.2 cutting undernutrition by half by 2025 would represent a reduction in costs of over 2.9 trillion UGX, equivalent to $US1.4 billion for the period of 16 years, from 2009 to 2025. Although the tendency of savings would not be linear, as they would increase over time with the achieved progress, a simple average of the annual savings would represent $US88 million per year. In the case of the Goal Scenario, the savings would increase to 4.3 trillion shilling, or $US2.1 billion, which represent a simple average of $US131 million per year.

TABLE IV.2
ESTIMATED SAVINGS FOR EACH SCENARIO, 2009
(In millions of UGX) [a/]

	Cutting Undernutrition by Half by 2025	Goal Scenario
Heath Costs		
Reduced Morbidity	982,956	1,492,791
Education Cost		
Reduced Grade Repetition	15,703	24,449
Productivity Costs		
Higher Productivity in Non-Manual Activities	377,253	537,878
Higher Productivity in Manual Activities	347,566	543,708
Increased Working Hours	1,145,739	1,671,776
Total Savings	2,869,217	4,270,602
Total Savings in millions of $US	1,413	2,103

Source: Model estimations
a/ All values in net present values at an 8% social discount rate

Section V:
Conclusions and Recommendations

V Conclusions and Recommendations

A. Conclusions

The Cost of Hunger in Africa (COHA) Study presents an opportunity to better understand the role that child nutrition can play as a catalyst for social and economic transformation, and human development. This report marks an important step forward for Uganda, serving as a gateway for policy-makers to understand the socio-economic consequences of child undernutrition on Uganda's economy and population.

The results of the study strongly suggest that, in order for Uganda to achieve sustainable human and economic growth, special attention must be given to addressing nutrition in the early stages of an individual's life. The results of the study are supported by a nationally representative evidence-base, and a model of analysis specially adapted for the African context. The model uses nationally collected data to estimate the additional costs in health, education and productivity that are incurred as a result of child undernutrition. This study further quantifies the potential gains of addressing child undernutrition as a priority. As a result of this study, stakeholders now not only have the ethical imperative to address child nutrition, but a strong economic rationale to position nutrition at the centre of Uganda's development agenda.

The study estimates that child undernutrition generates health costs equivalent to 11% of the total public budget allocated to health. These costs are due to episodes directly associated with the incremental quantity and intensity of illnesses that affect underweight children and the protocols necessary for their treatment. It is also important to note that only 1 out of every 5 children is estimated to be receiving proper health attention. As the health coverage expands to rural areas, there will be an increase of people seeking medical attention; this can potentially affect the efficiency of the system to provide proper care services. This study illustrates that a reduction of child undernutrition could facilitate the effectiveness of this expansion by reducing the incremental burden generated by the health requirements of underweight children.

Further, the study estimates that 15% of all cases of child mortality are associated with the higher risk of undernutrition. Hence, a preventive approach to undernutrition can help reduce this incremental burden to the public sector, and also reduce the costs that are currently being covered by caretakers and families.

Increasing the educational level of the population, and maximizing the productive capacity of the population dividend, is a key element to increase competitiveness and innovation. This represents a particular opportunity in Uganda where the population under 15 years is estimated to be 48% of the total population. These children and youth must be equipped with the skills necessary for competitive labour. Thus, the underlying causes for low school performance and early desertion must be addressed. As there is no single cause for this phenomenon, a comprehensive strategy that considers improving in the quality of education and the conditions required for school attendance must be put in place. This study demonstrates that stunting is one barrier to attendance and retention, and to effectively elevate the educational levels and improve individuals' labour opportunities in the future, this barrier must be removed.

The study estimated that children who were stunted experienced a 3.1% higher repetition rate in school. As a result, 7% of all grade repetitions in school were associated to the higher incidence of repetition that is experienced by stunted children. 96% of these grade repetitions occur in primary school, suggesting that a reduction in the stunting prevalence could also support an improvement in schooling results, as it would reduce preventable burdens to the education system.

On the African continent, more than half of the population is expected to live in cities by 2050. An important component to prepare for this shift is to ensure that the workforce is ready to make a transition towards a more skilled labour, and economies are able to produce new jobs to reduce youth unemployment. By preventing child stunting thus avoiding the associated loss in

physical and cognitive capacity that hinders individual productivity, people can be provided with a more equal opportunity for success.

The study estimates that 54% of the working age population in Uganda is currently stunted. This population has had lower schooling levels than those who did not experience the average loss of 1.2 years in school. As the country continues to urbanize, and an increasing number of people participate in skilled employment, this loss in human capital will be reflected in a reduced productive capacity of the population. Thus, it may be a particularly crucial time to address child undernutrition and prepare future youth for better employment by prioritizing the reduction of stunting in Uganda's transformation agenda.

The COHA model also provides an important prospective analysis that sheds light on the potential economic benefits to be generated by a reduction in the prevalence of child undernutrition. The model estimates that in Uganda, a **reduction of the prevalence to half of the current levels of child undernutrition by the year 2025 can generate annual average savings of UGX 174 billion ($US86 million). An additional scenario shows that a reduction to 10% stunting and 5% underweight for that same period could yield annual average savings of UGX 260 billion ($US128 million).** This economic benefit that would result from a decrease in morbidities, lower repetition rates and an increase in manual and non-manual productivity, presents an important economic argument for the incremental investments in child nutrition.

This study is also an important example of how **South-South collaboration** can work to implement cost effective activities in development and knowledge sharing. Uganda's participation as one of the pilot countries of the study, and its feedback in challenges faced in collecting the data at national level was an important element in adapting the COHA methodology to Africa. The contributions of the Uganda NIT will serve to facilitate the expansion of this tool in the continent.

Lastly, this study illustrates the valuable role that **data and government-endorsed research can play in shedding light on pertinent issues on the continent.** This study will help the country engage within global nutrition movements such as the Scaling Up Nutrition Initiative as programmes and interventions are put in place to address stunting as a national priority.

Recommendations

This study presents some key findings of the Cost of Hunger in Uganda, as well as, both challenges and opportunities regarding the reduction of child undernutrition to the country.

i. Recommendations for on-going interventions

The Government of Uganda and its development partners have a series of activities in place, which in most cases, are demonstrating results in the reduction of child undernutrition. Nevertheless, an improvement in the reduction rate will require a scaling-up in current interventions that have proved effective. Some of the actions recommended by the NIT include the following.

- **Promotion of access to and utilization of essential services.** The Government of Uganda has put in place maternal child health services such as Pre Natal Care (PNC), Ante Natal Care (ANC), and young child health services provided through the health delivery system. These are directed at ensuring healthy pregnancies and good birth outcomes are achieved while promoting positive health seeking behaviour. However, the coverage and utilization is still remain limited. To increase the rate of reduction of child stunting in Uganda, **it is recommended that the health system outreach services coupled with logistics and supplies management be strengthened and supported to facilitate access and promotion of the utilization of services at community and household level**.
- **Scaling up of food fortification for school going children and children above 6 months**. In Uganda, consumption of balanced diets is often limited to the affluent population group mostly located in the urban areas. The bigger proportion of Uganda's population is located in the rural areas. While access to food may not always be a problem, food diversity is limited and food consumed depends on the region. Worse still, the complementary foods used for children above six months of age are often starch-based and of low nutrient value. Children in primary school face similar challenges of limited diversity. Given the strong link between micronutrient deficiencies and stunting, **it is recommended that flour fortification is scaled up to facilitate mandatory use of fortified food in school meals and ensure increased nutrient intake for school going children**.
- **Promotion of the consumption of fortified complementary food especially in populations most affected by micronutrient deficiencies and stunting**. This could include exploring home fortification using Micronutrient powders as a strategy for improving the quality of complementary food for children above 6 months of age.
- **Promotion of Public-Private Partnerships**. Encouraging public-private partnerships can serve as a way to engage the private sector (especially in the food production and processing industry) to incorporate the health and nutritional needs of the population in their products, promotions and distribution mechanisms. This might also assist in addressing the constraints (such as raw material imports, taxes on processing technology equipment, fortificants, etc) of the private sector related to coming up with the right products.
- **Increase efforts and explore further opportunities in bio-fortification**. Given that most rural communities practice subsistence farming and may not be able to access fortified food products due to either remoteness or affordability, biofortification of common staples such as beans, maize, sweet potatoes could be promoted through the Ministry of Agriculture and other existing mechanisms in order to allow households practicing subsistence farming access to improved food commodities from their own production.
- **Promotion of awareness of the entire population**. The government supports awareness activities through various sectors and mechanisms. Nutrition awareness remains limited across the whole population including the educated. The demonstrated impact of nutritional deficiencies in most parts of the country requires enhancing the awareness on the importance of nutrition especially in the first 1000 days of a child's life and the school-going age group. This would facilitate nutritional and growth catch-up during the early childhood (from two to five years).
- **An important mechanism to help raise this awareness is to increase nutrition sensitization actions in existing sector activities**. These may include developing a nutrition hand guide that facilitates not only the literate but also educators on the locally available food commodities that could be used, blended, processed to develop a nutritionally enriched food that can be used by the various vulnerable groups. The last version of such a guide for Uganda was last updated in 1969. An updated version the takes into account foods that have since been introduced into country (as imports or locally grown) could be considered.

ii. Recommendations for addressing bottlenecks:

Addressing the bottlenecks that undermine the efficiency of existing interventions. In order for nutrition intervention to maximize their results, certain elements, that are not directly within the scope of the activities themselves must be addressed, in order to achieve a sustained reduction in child undernutrition.

Coordination of multi-sectoral nutrition interventions for common objective of addressing undernutrition:

- A clear recommendation coming out of this study is that the **Government of Uganda needs to review its national strategies to ensure that the stunting is an outcome indicator of the country's social and economic development framework.** Chronic child undernutrition can no longer be considered a sectoral issue, as both its causes and solutions are linked to social policies across numerous sectors. As such, stunting reduction will require interventions from the health, education, social protection, and social infrastructure sectors and serve as an effective indicator of success in larger social programs.
- **Support the Office of the Prime Minister UNAP secretariat** in their coordination role of ensuring the different sectors play their role in contributing to the implementation of the national nutrition plan is critical.
- **From the policy perspective,** an enabling policy environment to facilitate planning and implementation of the above recommendations will be much needed, for example mandatory large scale industrial fortification of common staples widely consumed such as wheat, maize and vegetable oil, mandatory use of fortified maize flour and vegetable oil in school meals.
- This study has allowed participating countries to re-evaluate what are considered to be "acceptable" levels of stunting, and as such **recommends that aggressive targets are set in Uganda for the reduction of stunting and establishing a goal of 10% reduction**.
- To have a decisive impact on improving child nutrition, the multi sectoral nutrition framework (UNAP) currently in place needs strong political commitment and allocation of adequate resources for its implementation.
- It is of paramount importance that enhanced national capacity to address undernutrition is coupled with effective monitoring and evaluation systems. Currently, assessments on the prevalence of child under nutrition are carried-out every 3 to 5 years. **In order to accurately measure the short term results of stunting prevention, a more systematic approach with shorter assessment period of every 2 years is recommended.** As the focus on the prevention of child undernutrition should target children under 2 years of age, these results will provide information to policy makers and practitioners on the results being achieved in the implementation of social protection and nutrition programmes.
- Understanding of the determinants of child undernutrition in each context is also very important and as an initial step, it is **recommended that the assessment of child nutrition in Uganda includes information that relates the nutritional status of the children to the livelihoods and economic activities of the households**. This information can be used to inform programme design to ensure that interventions effectively reach vulnerable families with appropriate incentives and innovative approaches within social protection schemes.

Section VI: Annexes

VI Annexes

Annex 1. Glossary of Terms

1. **Average number of days require for hospitalization:** The average number of days a child needs to stay in a hospital when hospitalized, to receive adequate care.
2. **Average number of days required for ICU:** The average number of days a child needs to stay in the ICU when put in ICU care, to receive adequate care.
3. **Average number of primary care visits per episode:** When a child experiences a given pathology, he/she may require medical care multiple times. This variable is the average number of primary (outpatient) medical care visits a child requires per episode.
4. **Average waiting time spent at primary care:** When a caretaker brings a child to a primary care facility, the time the parent and child spend at the facility for waiting and receiving care.
5. **Cost of medical inputs per event during hospitalization:** This variable includes the medical materials (medicines, procedures) that are covered by the hospital for treatment of each pathology case.
6. **Cost of medical inputs per event in ICU:** This variable includes the medical materials (medicines, procedures) that are covered by the hospital for treatment of each pathology case in ICU.
7. **Cost of medical inputs per event in primary care:** This variable includes the medical materials (medicines, procedures) that are covered by the health facility for treatment of each pathology case.
8. **Costs not covered by the health system:** This variable includes the value of the inputs (i.e. medications) that are paid for by the family.
9. **Daily cost of hospital bed during hospitalization:** This variable includes the total cost to the hospital calculated per day per patient staying in the hospital. This value includes the cost of staff, facilities and equipment, as a unit cost per patient.
10. **Daily cost of hospital bed in ICU:** This variable includes the total cost to the hospital calculated per day per patient staying in the ICU. This value includes the cost of staff, facilities and equipment, as a unit cost per patient.
11. **Daily hours lost due to hospitalization:** The number of hours the caretaker spends at the hospital each day with the child when he/she brings a child to a primary care facility.
12. **Differential Probability (DP):** Refers to the difference between the probability of occurrence of a consequence (i.e., disease, grade repetition and lower productivity) given a specific condition. The model uses this variable specifically to determine the risk among those suffering from undernutrition and those who are not (ECLAC).

13. **Discount rate:** The interest rate used to assess a present value of a future value by discounting (FAO). In the model it is utilized to obtain the present value in the scenario section.
14. **Dropout rate per grade:** Percentage of students who drop out of a grade in a given school year (UNESCO).
15. **Episodes:** It is the number of disease events occurring for a given pathology. In the model it is based on a 1 year period, i.e. the number of times a specific pathology occurs in 1 year (ECLAC).
16. **Food insecurity:** Exists when people lack access to sufficient amount of safe and nutritious food and therefore, are not consuming enough for an active and healthy life. This may be due to the unavailability of food, inadequate purchasing power or inappropriate utilization at household level (FAO).
17. **Food vulnerability:** Reflects the probability of an acute decline in food access or consumption, often in reference to some critical value that defines minimum levels of human wellbeing (WFP).
18. **Hunger:** The status of persons, whose food intake regularly provides less than their minimum energy requirements, i.e. about 1800 kcal per day. It is operationally expressed by the undernourishment indicator (FAO).
19. **Incidental retrospective dimension:** Used to estimate the cost of undernutrition in a country's population in a given year. The model applies it by looking at the health costs of pre-school children (0 to 5-year-olds) suffering from undernutrition, the education costs of school-age children (6 to 18-year-olds) and the economic costs resulting from lost productivity by working-age individuals (15 to 64-year-olds) (ECLAC).
20. **Intrauterine growth restriction (IUGR):** Refers to the foetal weight that is below the 10th percentile for gestational age (WHO). In the model, this is the only type of condition considered in the estimation of cost for low birth weight children.
21. **Low Birth Weight (LBW):** A newborn is considered to have low birth weight when he/she weighs less than 2,500 grams (WHO).
22. **Malnutrition:** A broad term for a range of conditions that hinder good health caused by inadequate or unbalanced food intake or by poor absorption of the food consumed. It refers to both undernutrition (food deprivation) and over nutrition (excessive food intake in relation to energy requirements) (FAO).
23. **Mortality rate:** The proportion of deaths per year in a given population, usually multiplied by a 10th population size so it is expressed as the number per 1,000, 10,000, 100,000, individuals per year.
24. **Percentage of cases that attend health services:** The proportion of episodes for which a caretaker brings a child to a primary health facility for treatment.
25. **Productivity/Labour productivity:** Measures the amount of goods and services produced by each member of the labour force or the output per unit of labour (ILO). In the model, it refers to the average contribution that an individual can make to the economy, measured by consumption or income, depending on data availability.
26. **Proportion of episodes requiring hospitalization:** When a child experiences pathology, he/she may require in-patient care. This variable identifies the proportion of the episodes by pathology, for which a child requires hospitalization.
27. **Proportion of episodes requiring ICU:** When a child experiences pathology, he/she may require care in an ICU facility. This variable identifies the proportion of the episodes by pathology, for which a child requires ICU care.
28. **Prospective or potential savings dimension:** This dimension makes it possible to project the present and future losses incurred as a result of medical treatment, repetition of grades in school and lower productivity caused by undernutrition among children under the age of five in each country, in a specific year (ECLAC).
29. **Public social spending:** Social expenditure is the provision by public (and private) institutions of benefits to, and financial contributions targeted at, households and individuals in order to provide support during circumstances, which adversely affect their welfare, provided that the provision of the benefits and financial contributions constitutes neither a direct payment for a particular good or service nor an individual contract or transfer (OECD).

30. **Relative risk:** Refers to the risk of an event occurring, given a specific condition. It is expressed as a ratio of the probability of the event occurring in the exposed group versus a non-exposed group. In the model it is used to establish the risk level of disease, lower educational performance or lower productivity relative to exposure to undernutrition.
31. **Repetition rate per grade:** Number of repeaters in a given grade in a given school year, expressed as a percentage of enrolment in that grade in the previous school year (UNESCO).
32. **Stunting:** Reflects shortness-for-age; an indicator of chronic malnutrition, calculated by comparing the height-for-age of a child with a reference population of well-nourished and healthy children (WFP). The model uses it as the indicator to analyse the impact on educational performance and productivity.
33. **Survival rate:** A rate calculated for a given geographic area that presents the likelihood of a person surviving in a given period of time.
34. **Undernourishment:** Food intake that is continuously insufficient to meet dietary energy requirements. This term is used interchangeably with chronic hunger, or, in this report, hunger (FAO).
35. **Undernutrition:** The result of prolonged low levels of food intake and/or low absorption of food consumed (undernourishment). It is generally applied to energy (or protein and energy) deficiency, but it may also relate to vitamin and mineral deficiencies (FAO).
36. **Underweight:** Measured by comparing the weight-for-age of a child with a reference population of well-nourished and healthy children (WFP). The model utilizes it to analyse the impact of child undernutrition on health.
37. **Unit cost per attention in primary care:** This variable includes the total cost to the health facility per attention, comprising the cost of staff, facilities and equipment, as a unit cost per patient.
38. **Wasting:** Reflects a recent and severe process that led to substantial weight loss, usually associated with starvation and/or disease. Wasting is calculated by comparing weight-for-height of a child with a reference population of well-nourished and healthy children (WFP).

Annex 2. Methods and Assumptions

Health Protocols and Prevalence Data

Information about this annex: The following information illustrates the variables used to estimate health costs. ADS is an acronym for acute diarrheal syndrome, ARI stands for acute respiratory infection, LBW – low birth weight and ICU is intensive care unit. In most cases, values were the same across the age groups.

Methods: These data are based on expert interviews with the following experts:

- Dr. Mugala Jamu, Medical Doctor in the General Special Care Unit, Mulago National Referral Hospital, Kampala, Uganda
- Dr. Nyombi Nata, Medical Doctor in the General Special Care Unit, Mulago National Referral Hospital, Kampala, Uganda
- Medical Doctors in the Private Special Care Unit, Mulago National Referral Hospital, Kampala, Uganda SCU - Private
- Dr. Kiguli , College of Health Sciences, Makerere University
- Dr. Elizabeth Kiboneka, Consultant Paediatrician, Mwana Mugimu Nutrition Rehabilitation Unit, Mulago National Referral Hospital, Kampala, Uganda
- Nurse in Charge, Acute Care Unit, Mulago National Referral Hospital, Kampala, Uganda
- Consultant Paediatrician, Acute Care Unit, Mulago National Referral Hospital, Kampala, Uganda
- The Planning Unit, Mulago National Referral Hospital, Kampala, Uganda
- Others e.g. USAID, MOH, MoES, MAAIF, UBOS

Additionally, some data are based on the Uganda Clinical Guidelines protocol and the Integrated Management of Acute Malnutrition (IMAM), developed by MOH.

1. Number of Disease Episodes (a)

Pathology	Methods	Data source	Assumptions
Anaemia	• Cost of Hunger (COH) model • Key informant interviews and expert consultations	• Uganda Demographic and Health Survey (UDHS) report of 2006 and 2011 • Interviews	• Considered moderate and severe cases • Considered averages
ADS			• Diarrhoea defined as passage of watery/loose stool more than 3 times in a period of 24 hours • Considered averages
ARI			• Respiratory Infection defined as cough accompanied by short rapid breathes. It is chest-related and is considered as a proxy for pneumonia • Considered averages
Malaria	• Cost of Hunger (COH) model • Key informant interviews and expert consultations • Review of secondary data	• Uganda Nutrition PROFILES 2009 • Uganda Malaria Indicator Survey (UMIS) • Uganda Demographic and Health Survey (UDHS) report of 2006 and 2011 • Interviews	• Given that Malaria is a common symptom, all types of fever were considered as Malaria • Considered averages

Pathology	Methods	Data source	Assumptions
Underweight	• Cost of Hunger (COH) model • Review of secondary data • Key informant interviews and expert consultations	• Uganda Nutrition PROFILES 2009 • Uganda Demographic and Health Survey (UDHS) report of 2006 and 2011 • Guideline on the Integrated Management of Acute Malnutrition (IMAM) • Relevant biomedical records at Mwana Mugimu National Nutrition Rehabilitation Unit • Interviews	• Follow-up visits to the facility after discharge not considered as new episodes

2. Average number of primary care visits per episode (b)

Definition: When a child experiences a given pathology, he/she may require medical care multiple times. This variable is the average number of visits a child would require per episode to primary (outpatient) medical care.

Pathology	Methods	Data source	Assumptions
Anaemia	• Cost of Hunger (COH) model • Key informant interviews and expert consultations • Review of secondary data	• Uganda Demographic and Health Survey (UDHS) report of 2006 and 2011 • Uganda Clinical Guideline 2010 • Interviews	• A child with moderate anaemia will receive the full dosage of medications on the first visit to the primary health care facility • All facilities are testing for anaemia at the outpatient department
ADS			• Each child with moderate ADS is treated on outpatient basis and is given full dosage medications at once, without follow up
ARI			• Although a full dosage of antibiotics is usually provided to a child on the first visit, on average, the child is expected to come for two follow-up visits • Facilities have capacity to diagnose and treat ARI
Malaria		• Uganda Malaria Indicator Survey (UMIS) • Uganda Clinical Guideline 2010 • Uganda Demographic and Health Survey (UDHS) report of 2006 and 2011 • Interviews	• A child diagnosed with first-line Malaria is treated on an outpatient basis and with the full dosage of malaria medications without follow-up visits • Facilities have capacity to diagnose, classify and treat Malaria
Underweight		• Uganda Demographic and Health Survey (UDHS) report of 2006 and 2011 • Guideline on the Integrated Management of Acute Malnutrition (IMAM) • Relevant biomedical records at Mwana-Mugimu National Nutrition Rehabilitation Unit • Interviews	• Considered children who have visited primary care as outpatients • Considered follow-up visits of discharged hospitalized cases as new episodes

3. Proportion of episodes requiring hospitalization (c)

Definition: When a child experiences pathology, they may require in-patient care. This variable identifies the proportion of the episodes for which a child requires hospitalization, by pathology.

Pathology	Methods	Data source	Assumptions
LBW	• Key informant interviews and expert consultations • Review of secondary data	• Uganda Nutrition PROFILES 2009 • Uganda Demographic and Health Survey (UDHS) report of 2006 and 2011 • WHO protocol on LBW • Interviews	• All children born with low birth weight were hospitalized
Anaemia		• Uganda Demographic and Health Survey (UDHS) report of 2006 and 2011 • Uganda Clinical Guideline 2010 • Interviews	• All severe cases were hospitalized • Health facilities have capacity to diagnose and treat Anaemia
ADS			• All severe cases were hospitalized • All children given intravenous solution were those who were hospitalized • Health facilities have capacity to diagnose and treat ADS
ARI			• All severe cases were hospitalized • Health facilities have capacity to diagnose and treat ARI
Malaria		• Uganda Demographic and Health Survey (UDHS) report of 2006 and 2011 • Uganda Clinical Guideline 2010 • Interviews	• Children given quinine treatment were those who were hospitalized • Health facilities have capacity to diagnose and treat Malaria
Underweight		• Uganda Demographic and Health Survey (UDHS) report of 2006 and 2011 • Guideline on the Integrated Management of Acute Malnutrition (IMAM) • Uganda Clinical Guideline 2010 • Uganda Nutrition PROFILES 2009 • Interviews	• All severe cases were hospitalized • Health facilities have capacity to assess and manage underweight

4. Average number of days required for hospitalization (d)

Methods and Assumptions: Averages based on cases without complications.

5. **Proportion of episodes requiring ICU (e)**

Pathology	Methods	Data source	Assumptions
LBW	• Key informant interviews and expert consultations • Review of secondary data	• Uganda Demographic and Health Survey (UDHS) report of 2006 and 2011 • WHO protocol on LBW • Interviews	• All LBW cases go to the ICU • Health facilities have capacity to diagnose and treat LBW in ICU
Anaemia, ADS, ARI, Malaria		• Uganda Demographic and Health Survey (UDHS) report of 2006 and 2011 • Uganda Clinical Guideline 2010 • Interviews	• From a paediatrics expert, on average, without consideration of number of times the child has been hospitalized previously • Health facilities have capacity to diagnose and treat Anaemia, ARI, ADS with severe complications
Underweight		• Uganda Nutrition PROFILES 2009 • Guideline on the Integrated Management of Acute Malnutrition (IMAM) • Uganda Clinical Guideline 2010 • Interviews	• All cases of underweight with severe complications are considered as ICU cases • Health facilities have capacity to diagnose and manage underweight with severe complication in ICU

6. **Average number of days required for ICU (f)**

Assumptions: Average stay in ICU for all pathologies in the hospital was added to the number of days in the hospital.

7. **Average waiting time spent at primary care (g)**

Assumptions: Average waiting time to receive treatment for all pathologies is three hours.

8. **Daily hours lost due to hospitalization (h)**

Assumptions: When a child is in the hospital, at least one parent will spent a full day with that child.

Costing Data

1. **Primary Care: Unit Cost per attention (j)**

Assumptions: Including the cost of human resources for medical workers caring for child on out-patient basis.

2. **Primary Care: Cost of medical inputs per event (k)**

Pathology	Methods	Data source	Assumptions
LBW, Anaemia, ADS, ARI, Malaria	• Key informant interviews and expert consultations • Review of secondary data	• Catalogues on drug prices from National Medical Stores and Joint Medical Stores • Uganda Clinical Guideline 2010 • Hospital drug, consumables and equipment test lists • Interviews	• Prices are consistent and not affected by inflation. Limited by data collection process carried-out in 2012.
Underweight	• Review of secondary data	• UNICEF procurement • Interviews	

1. **Hospitalization: Daily cost of hospital bed (l)**

   Assumptions: (i) Standard cost across pathologies for the sample hospital, (ii) Hospital bed charges includes costs for human resources.

2. **Hospitalization: Cost of medical inputs per event (m)**

   Assumptions: Hospitalization charges include cost of drugs, sundries and laboratory tests.

3. **ICU: Daily cost of hospital bed (n)**

   Assumptions: (i) Standard cost across pathologies for the sample hospital, (ii) Hospital bed charges includes costs for human resources.

4. **ICU: Cost of medical inputs per event (o)**

   Assumptions: ICU charges include cost of drugs, sundries, oxygen and laboratory tests.

5. **Costs not covered by the health system (p)**

   Assumptions: Public hospitals cover at least 50% of the patient costs.

6. **Percentage of cases that attend health services (q)**

   Assumptions: Information provided from UDHS, 2011, expert opinion, and the Ministry of Health Statistical Abstract Report, 2010.

Variables for Health Costing

Process of costing of the pathologies	
Cost treating severe acute malnutrition	**Comments and Sources**
To estimate the costs of managing Severe Acute Malnutrition, Mulago Referral Hospital (Mwana Mugimu Nutrition Unit) retrieved primary data from the client files from 2009, where variables like age, weight, height, whether or not the child had oedema, whether the child was taken to the intensive care unit and the days of stay for treatment were recorded. This helped to extract data on average number of hospital stay for hospitalized children.	The costs of treating stunting or underweight cannot be calculated, so only SAM was calculated. Source: expert opinion on costs, Director/Paediatric Doctor and Nutritionist Mwana Mugimu Nutrition Unit (MNU), Mulago Hospital. Uganda Clinical Guidelines protocol and the IMAM Guidelines to get the standard treatment of malnourished children for the different age category.
The costs for hospitalized cases included costs of drugs, feeds, laboratory tests, sundries and human resources was based on Mulago and NMS and JMS catalogues for medicine/equipment prices.	
Unit cost for attention	
This includes the cost of human resources, i.e. for the time a medical worker dedicates to a child on an outpatient basis.	
Primary care - Medical inputs	
For outpatient cases, only the cost of drugs (multi-vitamins, RUTF) was included for the 6 times the child goes to complete the treatment.	
Hospitalized - Medical inputs	
This included costs of drugs, sundries and laboratory tests for the 22 days the child is in the health facility.	
Intensive Care Unit - Medical inputs	
This included costs of drugs, sundries, laboratory tests and oxygen related requirements for the 22 days the child is in the health facility.	
Daily cost of a hospital bed	
The cost of a hospital bed is a standard cost for all the pathologies.	
Cost of medical inputs not covered by the health system	
It was assumed that public hospitals provide at least 50% of the cost of outpatient medical inputs, while the other 50% is borne by the caretaker of the	

Process of costing of the pathologies	
child.	
Percentage of cases who attend health services	
Data compiled from sources like UDHS, 2011, expert opinion and the percentage of deliveries in government and NGO hospitals (source: MoH Statistical Abstract Report, 2010).	
Cost of treating; Malaria, Anaemia, ADD, ARI and LBW	**Comments and Sources**
For malaria, anaemia, ADS and ARI, the Acute Care Unit (ACU), Mulago Hospital was consulted for information and the Special Care Unit (SCU) was contacted for information on low birth weight (LBW); both Units are under the Paediatrics department, Makerere University School of Public Health.	The key experts included Officers in Charge of the different units since they have hands-on experience (Paediatric department-Acute Care Unit and Special Care Unit), Mulago Hospital. . Uganda Clinical Guidelines, 2010 for disease treatment protocols.
The same tool, as with undernutrition, was used to get information for the other pathologies.	
The cost of medical inputs for outpatients included costs of drugs, laboratory tests and sundries for malaria, ARI, ADS and anaemia, considering also the multiple visits a child needs to make to the health facility for treatment, (one visit for malaria, 3 for ARI, 2 for ADS and one for anaemia) .	
The cost of medical inputs for hospitalized cases included costs of drugs, sundries and laboratory tests for the days the child is hospitalized in the health facility due to malaria, anaemia, ADS and ARI, (8 days for malaria, 3 days for anaemia, 2 days for ADS and 7 days for ARI).	
The cost of ICU was estimated as the one for malnutrition included drugs, sundries, laboratory tests and oxygen related requirements..	
The unit cost for attention for all pathologies includes the cost of human resources for the time the medical worker dedicates to a child on an outpatient basis.	
Daily cost of a hospital bed is a standard cost for all the pathologies.	
Cost of medical inputs not covered by the health system: it was assumed that public hospitals provide at least 50% of the cost of outpatient medical inputs, while the other 50% is borne by the caretaker of the child.	
Percentage of cases who attend health services: This was compiled from sources like UDHS, 2011, expert opinion and the percentage of deliveries in government and NGO hospitals (source: MoH Statistical Abstract Report, 2010).	
To determine ARI costs, the cost for treating severe pneumonia was computed since ARI's symptoms are used as proxy for pneumonia.	
Number of annual disease events (incidence)	**Comments and Sources**
LBW: 1 represents the one time a child has LBW (<2.5kg) when he/she is born.	Source: Expert opinion Dr. Kiboneka Elizabeth, Director Mulago Nutrition care unit, Mwana Mugimu Dr. Mugala Jamu, Special Care Unit (SCU), General Mulago Hospital Dr. Nyombi Nata, SCU, General Mulago Hospital Dr. Anita SCU- Private Dr. Kiguli, Head of Paediatric Department,
Malnutrition: The assumption was that a child gets malnourished only once a year.	
Malaria: On average it is considered that a child has only 1.5 episodes of malaria in a year. Depending on the geographical area some areas have 3 episodes while others one.	
Anaemia: Included only moderate and severe cases of anaemia. It is assumed that a child gets only one episode of Anaemia per year.	
ADS: It is assumed that a child gets about 2 episodes of ADS per year.	
ARI: It is assumed that a child gets 3 episodes of ARI in a year.	

Process of costing of the pathologies	
	Mulago Hospital
Average number of primary care visits for each event	**Comments and Sources**
The primary care visits refer to the number of times a child is brought to the health facility, followed up after being discharged and brought back to the outpatient department because of an illness.	Source: This is based on the actual average number of days a child would usually spend on oxygen, (Mulago Hospital, IMAM Guidelines).
SAM: A child who has been discharged from the hospital or referred receives six follow-up visits (as outpatient) per event. A child visits the primary health care once a year with a new case of malnutrition.	
Malaria: Each child with first line malaria is treated on outpatient basis and is given anti-malarial drugs – a full dosage **once –** the day he/she comes to the health facility. Follow-up is not usually done. A child visits the primary care once a year.	
Anaemia: Each child with moderate anaemia is treated on outpatient basis and is given drugs – full dosage (folic acid/iron supplements etc) **once –** the day he/she comes to the health facility. Follow-up is not usually done. A child visits the primary care once a year.	
ARI: Each child with mild pneumonia is treated on outpatient basis and is given drugs – full dosage of antibiotics **once –** the day he/she comes to the health facility. Follow-up is not usually done. A child visits the primary care 3 times a year.	
ADS: Each child with moderate ADS is treated on outpatient basis and is given drugs – full dosage **once** – the day he/she comes to the health facility. Follow-up is not usually done. A child visits the primary health care twice a year.	
Proportion of events requiring hospitalisation	**Comments and Sources**
LBW: It isassumed that almost all cases of LBW are hospitalized, (expert opinion, Mulago Hospital).	Source: Nutrition PROFILES, 2009 and expert opinions from Mulago Hospital. Expert opinions included: Officers in Charge; Nurses and Paediatric Doctors of Acute Care Unit for SAM, malaria, anaemia, ARI and ADS, and Special Care Unit for LBW, (Mulago Hospital).
SAM: It is assumed thatSAM cases are hospitalized, (Nutrition PROFILES, 2009 and expert opinion).	
Malaria: It is assumed that children with severe malaria who were given quinine treatment are hospitalized cases.	
Anaemia: Only severe cases of anaemia are hospitalized. Anaemia is considered to be severe when <8/gDL, (UDHS, 2011).	
ARI: The figure was based on expert opinion.	
ADS: It is assumedthat children with ADS, who received intravenous solution as treatment for diarrhoea, were hospitalized (UDHS, 2011).	
Average number of days of hospital treatment for each event	**Comments and Sources**
This was based on protocols from the Uganda Clinical Guidelines, 2010, IMAM Guidelines and experience on the ground, especially for SAM cost estimations.	Uganda Clinical Guidelines, 2010, IMAM Guidelines.
LBW: 14 days for full-term LBW infants.	
SAM: The average length of stay is of 22 days, which corresponds to the number of days used in calculating SAM cost for medical inputs.	
For cases of **Malaria** - 8 days; **Anaemia**– 3 days; **ARI** – 7 days; and **ADS** – 2 dayson average, if without complications.	
Proportion of events requiring intensive treatment UTI/ICU	**Comments and Sources**

Process of costing of the pathologies	
LBW: For all hospitalized cases of LBW only about 3% don't go in the Intensive care unit (ICU), i.e. approximately 97% are usually admitted into ICU.	**Source**: Expert opinionfrom Acute Care Unit and Mwana Mugimu Nutrition Unit, Mulago Hospital.
SAM: Information retrieved from PROFILES, 2009 and expert opinion.	
Malaria, Anaemia, ARI and ADS: Information was received from a Paediatrics expert who indicated number of cases irrespective of the number of annual disease or proportion of events requiring hospitalization.	
Average number of days of intensive treatment UTI/ICU for each event.	**Comments and Sources**
The average length of stay in ICU is 4 days for all the pathologies.	Based on the actual number of days on average a child spends on oxygen, Mulago Hospital.
Average waiting time (in hours) to receive health services at primary care centre	**Comments and Sources**
The waiting time to receive health services for an outpatient is 3 hours on average for all the pathologies. For SAM cases caretakers/mothers receive health and nutrition education (within 3 hours), before going for a review/check-up by a Doctor orNurse.	Based on various expert opinions and observations, Mulago Hospital.
Daily hours lost due to hospitalisation	**Comments and Sources**
It is assumed that an individual works 8 hours per day.	The length of the work day (whether formal or informal) was determined by the Constitution.
Percentage of cases who attend health services	**Comments and Sources**
Refers to the percentage of cases who went to the health facility following different pathologies.	Expert opinion given by Dr. Wamani Henry, Head of Department School of Public Health, MoH Statistical Abstract Report, 2010, UNICEF and UDHS.

Variables for Education Section

Variable	Method	Data source
Enrollment	The education system in Uganda defines final enrolment as the number of students approved (i.e. numerical count of existing students/pupils in a school at a particular time)	Education management information system (EMIS)
Initial enrolment	Count of students/pupils as per admission forms	EMIS
Final enrolment	Count of students/pupils as per end of term exam sitting	EMIS
Number of passes	Count of students/pupils who acquire the minimum desirable pass grade	EMIS
Number of dropouts (rate)	Difference between initial and final enrollment	EMIS
Number of population repeating grades (rate)	Count of students/pupils who do not acquire the minimum required passing grade	EMIS
Absenteeism	Count of students/pupils who do not attend lessons for more than 2 days in a week	EMIS
Number of teachers hired by government	Count of teachers employed in schools as per the government payroll	EMIS
Education costs		

Private cost	Summation of the itemized education costs incurred by households per student/pupil	UNHS 2009-2010
Public cost	Computed using a unit allocation cost as per the UPE and USE Guidelines	Ministry of Finance

Variables for productivity costing

Variable	Method	Data sources	Assumptions
Average wage per hour	Total wage per person expressed as a ratio of the number of hours worked	UNHS 2009-2010	There is a known number of hours worked per person There is a known wage paid per person for a standard period of time (weekly, monthly)
Consumer price index	Obtained from UBOS monthly consumer price index press release	UBOS	
Average income per years of schooling	Individual income was computed as proportion of household income per number of working hours contributed by each of the working individuals in the household	UNHS 2009-2010	For an individual to have completed a level of education, he/she must have passed that level of education Number of years of schooling is equal to the education levels attained
Average income for manual activities	Income for individuals engaged in the subsectors of agriculture, forestry, fishery and mining	UNHS 2009-2010	Manual activities were restricted to the subsectors of agriculture, forestry, fishery, and mining.
Average income for non-manual activities	Income for individuals engaged in other subsectors excluding agriculture, Forestry, fishery and mining	UNHS 2009-2010	Non-manual activities were restricted to other subsectors excluding agriculture, forestry, fishery and mining
Average working hours	Total hours worked in a week by an individual as a ratio of number of days worked in a week	UNHS 2009-2010	

Annex 3. Brief Description of COHA Data Collection Process

The initial efforts of the National Implementation Team focused on searching for existing secondary data on health costs. Nevertheless, in the absence of this information, a taskforce team was created to undertake a baseline study in Mulago National and Jinja Regional Referral Hospitals. However, limitations in time and resources only allowed the health data collectors to use Mulago Hospital as a reference.

The data collection taskforce was comprised of Nancy Adero, a nutritionist who started collecting data while working with the World Food Programme and later with the National Planning Authority and Twaha Rwegyema, a nutritionist seconded by the Ministry of Health.

The taskforce carried out field visits to the Planning Unit at Mulago Hospital to obtain treatment protocols for the different pathologies and the associated budgets. This information was standardised for drugs, laboratory tests, etc. with minimal variations. Nevertheless, the initial analysis seemed to indicate that the obtained values were not representative enough to be used for a national study.

A tool was thus developed by the health data collection team to provide guidance on health costing using the existing protocols (the Uganda Clinical Guidelines-UCG and IMAM Guidelines) as well as on-the-ground practice to determine costs for hospitalization, primary health care/outpatient and Intensive Care Unit-ICU necessary for treatment of different pathologies. The overall costs included mainly the payments for drugs, laboratory tests, sundries and human resources.

The cost for drugs and sundries were estimated using the National Medical Stores and Joint Medical Stores catalogues, whereas for laboratory tests the Mulago Hospital private wing costs were applied. To estimate the value for human resources two variables were taken into account - (a) the number of hours a Doctor or Nurse worked in a day, and (b) the length of hospitalization and outpatient follow-ups (taking into consideration the number of hours a medical officer worked on a patient per day).

Costs for primary health care and outpatient follow-up were determined mainly by the cost of a one-time full dosage of drugs and human resource needed to provide health services (expressed in minutes or hours). At times the cost of sundries was included in the computation.

In estimating the cost of medical inputs for ICU, particular ICU requirements (such as oxygen) were considered, in addition to the cost of medical inputs for hospitalization. Daily cost of a hospital bed for all pathologies was taken as a standard: 10,000 UGX per day.

For the purpose of the study, ARI was defined as cough accompanied by short rapid breaths that is chest-related, and was considered as a proxy for pneumonia. ADS referred to children suffering from diarrhoea during the 2 weeks preceding the survey. In the case of anaemia, only moderate and severe cases were considered, whereas LBW was defined as the weight of full-term babies born below 2.5kg. Most of the data were obtained from UDHS, 2011.

Various experts were contacted for further information and expert opinion during the study. For information on pathologies like malaria, anaemia, ARI and ADS the Acute Care Unit (ACU) and the Paediatrics department of Mulago Hospital were very helpful. The Special Care Unit (SCU) general and private wards provided information on Low Birth Weight (LBW) and the Mwana Mugimu Nutrition Unit provided insights and data on malnutrition. Other important sources of information included Mulago pharmacy, Makerere University School of Public Health, MoH, UNICEF and the Steering Committee composed of various stakeholders working in the health, education and productivity-related sectors, CSOs, and development partners, among others.

An important limitation to the analysis was the lack of differential costs for the different age groups of children under the age of five (i.e. 28 days to 11 months, 12 to 23 months and 24 to 59 months). This gap was identified following lack of registry on treatment for the most vulnerable period in an infant's life cycle, i.e. the first 24 months.

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