WFP/Nyani Quarmyne

Social and Economic Impact of Child Undernutrition on Ghana's Long-Term Development

THE COST OF HUNGER IN AFRICA | COHA

SOCIAL AND ECONOMIC IMPACT OF CHILD UNDERNUTRITION

GHANA

NATIONAL DEVELOPMENT PLANNING COMMISION (NDPC)

REPUBLIC OF GHANA

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, without prior permission.

Financial Support by:

WFP World Food Programme wfp.org

Rockefeller Foundation
Innovation for the Next 100 Years

Liberté • Égalité • Fraternité
RÉPUBLIQUE FRANÇAISE
MINISTÈRE DES AFFAIRES ÉTRANGÈRES

OCHA United Nations Office for the Coordination of Humanitarian Affairs

Social and Economic Impact of Child Undernutrition on Ghana's Long-Term Development

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

WFP/Nyani Quarmyne

Table of Contents

Foreword

The Cost of Hunger in Africa (COHA): The Ghana Report

Over the past two decades, Ghana has made some progress in improving the nutritional status of children, particularly those under 5 years of age, recording a substantial reduction in the prevalence of stunting, wasting and underweight among these children. According to the most recent edition of the Ghana Multiple Indicator Cluster Survey (MICS), in 2011, stunting among children 5 years and younger was 23 percent, down from 30 percent in 1988.

Also known as "chronic malnutrition," stunting is a condition where children under 5 years old are assessed to be too short for their age. Wasting, or "acute malnutrition," which carries an immediate increased risk of morbidity (disease) or mortality (death), refers to low weight-for-height, where a child is deemed too thin for his or her height. In 2011, about 6 percent of children were found to be wasting, an improvement on the 1988 figure of 8 percent. Underweight, which reflects a combination of "chronic and acute malnutrition," refers to low weight-for-age, a situation where a child can be either too thin or short for his or her age . About 13 percent of children under 5 years in Ghana were underweight in 2011, a substantial reduction from the 31 percent recorded in 1988. Despite this overall progress, child undernutrition remains unacceptably high in Ghana.

In March 2012, the African Union Commission (AUC), supported by the Economic Commission for Africa and the World Food Programme, launched The Cost of Hunger in Africa (COHA) to assist member states in establishing the social and economic impact of undernutrition on children and by extension national development. The study sought to estimate in a given year the additional cases of morbidity, mortality, school repetition, drop-out rates, and reduced physical capacity that could be associated with a person's undernutrition status before age 5.

The findings for Ghana, based on data provided by Ghana's COHA National Implementation Team, are discussed in this report, The Cost of Hunger in Africa: Implications for Ghana's Long-term National Development. The report underscores the importance of nutrition in human development and by extension the socio-economic transformation of a country. In particular, it demonstrates that for children, especially those from poor households, undernourishment has adverse implications for school performance, and for workers it reduces productivity and ultimately earnings and household welfare. The combined effect of these consequences is a cycle of poverty that undermines national and continental development efforts.

On the basis of these findings, the Ghana report estimated the associated cost to the domestic economy of malnutrition through health, education and labour in a single year. It found that in 2012, an estimated GH¢4.6 billion (or US$2.6 billion at the time) was lost to the economy as a result of child undernutrition. The report found that positioning nutrition interventions as a top priority for poverty reduction and broad-based development is often difficult, partly because of lack of data on their short- and long-term returns. Additionally, nutrition is too often regarded narrowly as "a health issue" only, when in fact it has broader social and economic implications.

The Report makes recommendations for addressing these gaps.

It is hoped that the COHA-Ghana Report would help raise awareness among policy makers and development practitioners about the necessity of prioritising nutrition in national development planning and allocating the necessary resources to it as part of a broader strategy for pursuing social and economic transformation in Ghana.

Dr. Nii Moi Thompson

Director-General
National Development Planning Commission

Acknowledgements

This document was prepared within the framework of the Memorandum of Understanding between the UN Economic Commission for Africa (ECA) and the World Food Programme (WFP). "The Cost of Hunger in Africa: The Economic and Social Impact of Child Undernutrition" has been made possible by the institutional leadership provided to this project by H.E Dr Nkosazana Dlamini Zuma, Chairperson, African Union Commission (AUC); H.E Dr Carlos Lopes, Executive Secretary, ECA; and H.E Mrs Ertharin Cousin, Executive Director, WFP. The implementation of the agreement was coordinated by H.E Dr Mustapha Sidiki Kaloko, Commissioner for Social Affairs at the AUC; Mr Thomas Yanga, Director of the WFP Africa Office; and Prof. Takyiwaa Manuh, Director of the Social Development and Policy Division at ECA. The design and implementation of the study was directed by a Steering Committee jointly led by Mrs Wanja Kaaria of the WFP Africa Office and Dr Janet Byaruhanga of the Health, Nutrition and Population Division of the Social Affairs Department at the AUC.

Special recognition goes to the National Implementation Team (NIT) in Ghana which was responsible for collecting, processing and presenting results. The team was guided by the National Development Planning Commission and was composed of the Ministry of Health, Ghana Health Service, Ghana Statistical Service, Ministry of Finance, Ministry of Food and Agriculture, Ministry of Education, Ghana Education Service, Ministry of Gender, Children and Social Protection, and Ministry of Employment and Labour Relations. The Scaling Up Nutrition (SUN) team, the Renewed Efforts against Child Hunger (REACH) team and UN agencies in Ghana provided support to the study. Non-governmental organisations such as Care International and Plan Ghana contributed as NIT members. Acknowledgment also goes to development partners in Ghana, various academics, Parliamentary Select Committees and nutrition champions. Thanks also go to the management of WFP Ghana for the immense support without which this study would not have been possible.

The regional support team was led by Dr Carlos Acosta Bermúdez and Mr Kalkidan Assefa, aided by Dr Jack Jones Zulu, Mr Iris Macculi, Mrs Melat Getachew with contributions from Mr Adrian Gauci and Mrs Semia Guermas Tapia all of ECA; Mrs Priscilla Wanjiru of WFP, and additional technical guidance from Mr Rodrigo Martínez and Mrs Amalia Palma of the Social Development Division of the Economic Commission for Latin America and the Caribbean (ECLAC).

Acronyms

ACS	African Centre for Statistics
ADFNS	Africa Day for Food and Nutrition
ADS	Acute Diarrheal Syndrome
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	Comprehensive Africa Agriculture Development Programme
COHA	Cost of Hunger in Africa
DHS	Demographic and Health Survey
ECLAC	Economic Commission for Latin America and the Caribbean
EDPRS	Economic Development and Poverty Reduction Strategy
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
ILO	International Labour Organization
IUGR	Intra Uterine Growth Retardation
LBW	Low Birth Weight
MICS	Multiple Indicator Clustor Survey
NEPAD	The New Partnership for Africa's Development
NIT	National Implementation Team
NPCA	NEPAD Planning and Coordinating Agency
OECD	Organization for Economic Cooperation and Development
PANI	Pan- African Nutrition Initiative
P4P	Purchase for Progress
REACH	Renewed Efforts Against Child Hunger
SAM	Severe Acute Malnutrition
SUN	Scaling Up Nutrition
UNECA	United Nations Economic Commission for Africa
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
WFP	World Food Programme
WHO	World Health Organization

Executive Summary

The Cost of Hunger in Africa (COHA) study 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. In March 2012, the regional COHA study was presented to African Ministers of Finance, Planning and Economic Development during the 5thjoint African Union (AU) and Economic Commission for Africa (ECA) Conference of Ministers of Economic Planning and Finance held in Addis Ababa, Ethiopia. At the meeting, the Ministers issued a resolution affirming the importance of the study and recommending that it should progress beyond the initial stage. Twelve countries were initially selected to participate in the study in phases, Ghana being among the four countries in the second phase to implement the study.

Methodology

The COHA model is used to estimate the additional cases of morbidity, mortality, school repetitions, and dropouts and reduced physical capacity that can be 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 data provided by the Ghana NIT, the model estimates the associated economic losses incurred by the economy in health, education and potential productivity in a single year. The reference year used in the analysis of the study model is 2012, which is referred throughout the text as 'current year'.

Trends in Child Undernutrition

Recent improvements in poverty rates in Ghana have been accompanied by a reduction in child undernutrition. However, stunting rates remain high. According to the 2011Multiple Indicator Cluster Survey (MICS, 2011), approximately 22.7 percent of Ghanaian children under the age of 5 were suffering from stunting, and 13.4 percent of children were underweight. In 2012, there were an estimated 827,533 (of the 3.6 million) children affected by stunting and almost 486,476 children were underweight. This situation is especially critical for children between 12 and 23 months, where 26.5 percent are affected by stunting, and 16.5 percent were underweight.

Initial Results: The Social and Economic Cost of Child Undernutrition in Ghana

Social and Economic Impacts on Health

- Overall, data from the MICS, 2011 show that 1,328,680 clinical episodes in Ghana in 2012 were associated with the higher risk of children being underweight, generating a total cost of GH¢357.8 million. Cases of diarrhoea, fever, respiratory infections and anaemia totalled 236,256 episodes in addition to the 1,054,902 cases of underweight children. According to the data estimates, only 42.7 percent of these episodes received proper health attention.
- Between 2008 and 2012 alone, it is estimated that 71,711 child deaths in Ghana were directly associated with undernutrition, which represent 23.8 percent of all child mortalities for this period. The model also estimated that 37.17 percent of the working-age population (5.488 million adults), suffered from growth retardation before reaching the age of five. Out of the total current working age population, 7.3 percent (i.e. 1,077,906 people who would be between 15-64 years old) has been lost due to the impact of undernutrition in increasing child mortality rates.

Social and Economic Impacts on Education

- The repetition rate for stunted children in 2012 was 4 percent, as compared to 3 percent for non-stunted children, i.e. an incremental risk of 1 percentage point for stunted children. Overall 10 percent (16,874) of all repetitions in 2012 were associated with stunting, with a total associated cost of GH¢14.9 million, some 34.4 percent of which was borne by the families.

[1] As the model set 2012 as the base year, it is referred to as "current" in this report.

- Stunting in childhood tends to result in lower educational attainment, which in turn has an impact on the expected level of income a person would earn as an adult. Based on historical information, the model estimates that 37.17 percent of the working age population in 2012 in Ghana were stunted as children

Social and Economic Impacts on Productivity

- Of the 8,230,455 people in Ghana that are engaged in manual activities, 3,384,680 (41 percent) were stunted as children. This represented an annual loss in potential income due to lower productivity that surpasses GH¢319 million (US$177.5 million at 2012 prices), equivalent to 0.44 percent of gross domestic product (GDP). The results further indicate that 2,672,591 people engaged in non-manual activities also suffered from childhood stunting. The estimated annual losses in productivity for this group are GH¢628 million (US$349 million), equivalent to 0.86 percent of GDP in 2012.

- An estimated 1,077,906 working hours were lost in 2012 due to workforce absenteeism as a result of incremental undernutrition-related child mortality. This represented GH¢3.319 billion (US$1.869 million), equivalent to 4.5 percent of GDP. Worth noting is the fact that the largest share of productivity loss is attributed to undernutrition-related mortality, which represented 77.8 percent of the total loss. Altogether, productivity loss in 2012 due to the impact of child undernutrition is GH¢4.267 billion (US$2.376 billion), equivalent to 5.8 percent of GDP.

Total Economic Impact

- An estimated GH¢4.6 billion (or US$2.6 billion) were lost in 2012 as a result of child undernutrition. These losses are equivalent to 6.4 percent of GDP in 2012. The highest element in this cost is the loss in potential productivity as a result of undernutrition-related mortalities.

Analysis of scenarios

Scenario	Scenario #1: Halving the Prevalence of Child Undernutrition by 2025		Scenario #2: The 'Goal 'Scenario: "10 and 5 by 2025"	
	GH¢ (in Millions)	US$ (in Millions)	GH¢ (in Millions)	US$ (in Millions)
Total Potential Savings (2012-2025)	4,422.6	2,462.7	5,627.7	3,133.8
Average Annual Savings (2012-2025)	340.2	189.4	432.9	241.1
Annual Percentage Reduction of Stunting Required (2012-2025)	0.87%		0.98%	

WFP/Photolibrary

Section I

The Cost of Hunger in Africa

The Cost of Hunger in Africa: Towards the Elimination of Child Undernutrition in Africa

A. Introduction: Why is it important?

Over the past decade, Africa has experienced a remarkable economic performance that has made the continent increasingly attractive 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[2]. Yet, the continent still displays some of the highest rates of child undernutrition in the world.

Quality human capital is the foundation of social and economic development as articulated in the Common African Position (CAP) and the Post-2015 Development agenda. 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 prospects, there is an urgent need for sustainable, cost-effective interventions that address the nutritional situation of the most vulnerable members of its society.

Achieving nutrition and food security would generate immediate impact on the achievement of the Millennium Development Goals (MDGs) and the future development aspirations of Africa. As noted by the African Heads of State and Government in 2014, food security without improved nutrition will not deliver the desired socio-economic outcomes; as the number of those affected by hunger and malnutrition has continued to increase over the past few years. Therefore, 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.[3] If girls were not undernourished, they would be less likely to bear underweight children. Further, healthy children would achieve better education, be more productive as adults and have higher chances of breaking the cycle of poverty.

Undernutrition leads to a significant loss in human and economic potential. The World Bank estimates that undernourished children are at risk of losing about 10 per cent of their lifetime earning potential, thus affecting 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.[4] At that conference, Nobel Laureate Economist, Vernon Smith stated that: "One of the most compelling investments is to get nutrients to the world's undernourished people. The benefits from doing so – in terms of increased health, schooling, and productivity – are tremendous."[5] Improving the nutritional status of children is therefore a priority for urgent policy attention to accelerate socio-economic progress and development in Africa. However, in spite of the compelling economic value of nutrition interventions, the tendency is to give priority in social budgets to investments with shorter-term returns. Hence, efforts need to be scaled up to sensitise the general population, policy makers and development partners on the high costs of undernutrition in order to strengthen national and international commitments and ensure that young children in Africa grow up healthy and properly nourished.

Positioning nutrition interventions as a top priority for development and poverty reduction is difficult, partly due to the lack of credible data on both short- and long-term returns. Indeed, there is not enough country-specific evidence to demonstrate how improved nutrition can have a direct impact on school performance, thereby improving opportunities in the labour market. Additionally, nutrition is too often regarded as "a health issue", disregarding its rippling implications for all areas of social and economic development.

Despite the aforementioned challenges, efforts continue, both at regional and global levels, to address the issues of undernutrition and hunger. At the regional level, these efforts include initiatives such as the African Regional Nutrition Strategy; the Comprehensive Africa Agriculture Development Programme (CAADP), especially CAADP Pillar III, focusing on reducing

2 "World Economic Outlook Database October 2012", World Economic Outlook Database October 2012, http://www.imf.org/external/pubs/ft/weo/2012/02/weodata/index.aspx.
3 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.
4 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.
5 Idem.

hunger and improving food and nutrition security; the Pan-African Nutrition Initiative (PANI); the Framework for African Food Security (FAFS); the Africa Ten-Year Strategy for the Reduction of Vitamin and Mineral Deficiencies (ATYS-VMD); and the African Day for Food and Nutrition Security (ADFNS). At the global level, initiatives include Renewed Efforts against Child Hunger (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 aim to reduce hunger, malnutrition and vulnerability, in convergence with achieving the unfinished business of the Millennium Development Goals, and the Sustainable Development Goals.

The Cost of Hunger Study on the Social and Economic Impact of Child Undernutrition in Africa is the product of the combined efforts of 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). It falls within the framework of the African Regional Nutrition Strategy (2005-2015) ,[6] tand is in line with the objectives of the African Task Force on Food and Nutrition Development [7] and CAADP. This study is built on a model developed by the United Nations Economic Commission for Latin America and the Caribbean (ECLAC) and the World Food Programme, Latin America. Through a South-South cooperation agreement, ECLAC has supported the adaptation of the model to the African context.

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

B. Current Food and Nutrition Situation in Africa

Globally, there has been tremendous progress in reducing both the rate of stunting (low height-for-age) and the number of stunted children over the past 20 years. In Africa, the reported incidence of stunted children has decreased from 41.6 percent in 1990 to 35.6 percent in 2011 (see Table 1.1). Nevertheless, over the same period, the absolute number of stunted children has increased from 45.7 million to 56.3[8] million. The largest proportion of these children, 22.8 million, is located in East Africa, representing more than 40 percent of all stunted children on the continent. Together with West Africa, they account for three out of four stunted children on the continent.

TABLE 1.1: ESTIMATED PREVALENCE AND NUMBER OF STUNTED CHILDREN UNDER FIVE YEARS OF AGE (MODERATE OR SEVERE), BY UN REGION: 1990, 2010, and 2011

	Prevalence estimate (%)			Number (millions)		
Region	**1990**	**2010**	**2011**	**1990**	**2010**	**2011**
Africa	**41.6**	**35.9**	**35.6**	**45.7**	**55.8**	**56.3**
Eastern	50.6	42.5	42.1	18	22.6	22.8
Middle	47.2	35.6	35	6.4	7.8	7.8
Northern	28.6	21.3	21	6.3	5	5
Southern	36.2	31.1	30.8	2.2	1.9	1.8
Western	39.1	36.5	36.4	12.8	18.6	18.9

Source: United Nations Children's Fund, World Health Organization, The World Bank. UNICEF-WHO-World Bank Joint Child Malnutrition Estimate.

The rising number of food insecure and undernourished people continues to pose serious challenges in Africa. Over the past few years, the increase in global food prices and the economic and financial crises have pushed more people into poverty,

[6] 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 [international] 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 outcomes, by providing guidance on strategic areas of focus.

[7] 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

[8] United Nations Children's Fund, World Health Organisation, World Bank. UNICEF-WHO-World Bank Joint Child Malnutrition Estimates. UNICEF, New York; WHO, Geneva; World Bank: Washington, DC,

vulnerability and hunger. Even though the number of undernourished people has fallen globally by 13.2 percent from 1 billion to 868 million in the last 20 years, Africa has fallen back, reporting an increase in the absolute number of undernourished people from 175 million to 239 million (see Table 1.2).[9] Africa's share in the world's undernourished population has also increased from 18 percent to 28 percent[10] calling for stronger efforts to improve food security and nutrition on the continent.

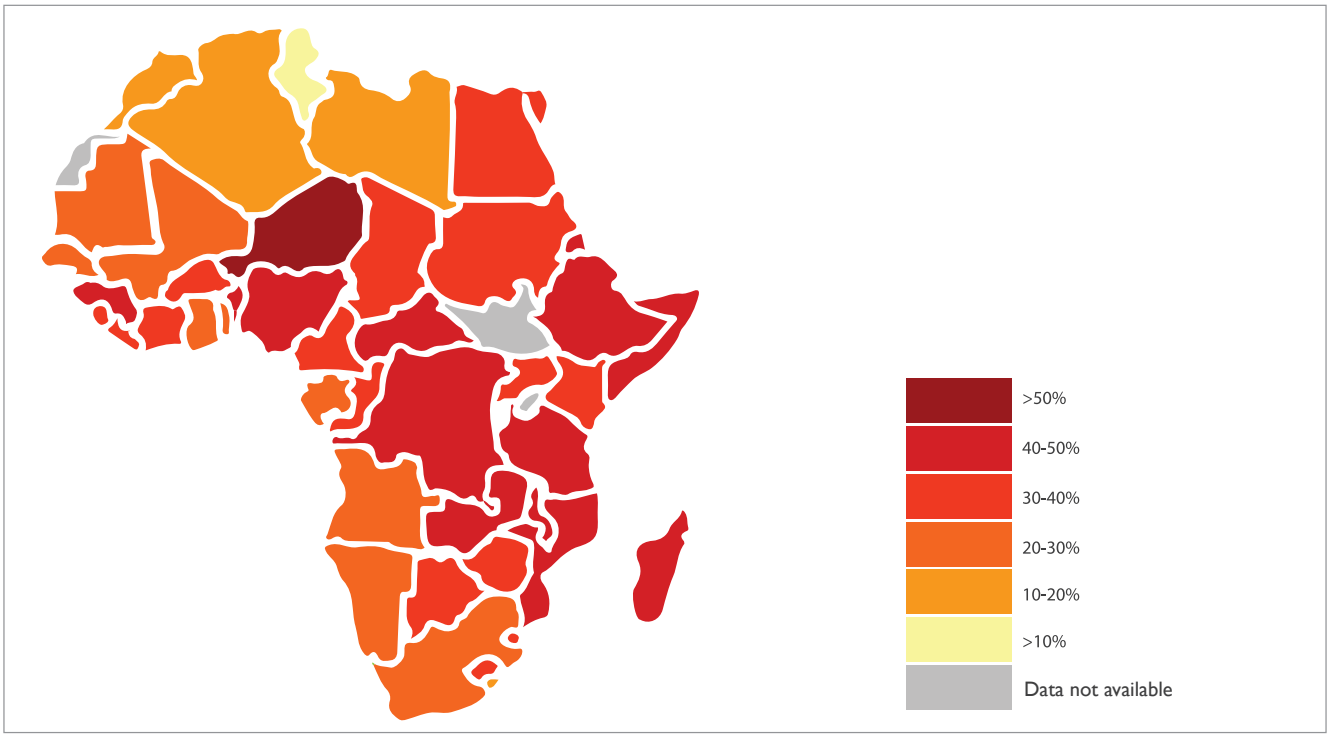
TABLE 1.2: NUMBER OF UNDERNOURISHED PEOPLE, BY REGION (In millions)

Region	1990-1992	Proportion	2010-2012	Proportion
Africa	175	18%	239	**28%**
Asia	739	74%	563	**65%**
Latin America & Caribbean	65	7%	49	**6%**
Oceania	1	0.1%	1	**0.1%**
World	1000		868	

Source: The state of food insecurity in the world 2012, Report, Food and Agriculture Organization (FAO).

Figure 1.1 below illustrates the rates of stunting (low height-for-age) in Africa. According to these data, 17 countries on the continent have stunting rates above 40 percent and 36 countries have rates above 30 percent. Furthermore, a large proportion of Africa's population often does not have access to food containing the essential vitamins and minerals required for optimum health and nutrition.

FIGURE1.1 STUNTING RATES BY COUNTRY



Source: Data from WHO Global Database on Child Growth and Malnutrition

The first Millennium Development Goal (MDG 1) called for the eradication of extreme poverty and hunger. Nutritional status of children under 5 years of age was a key indicator to assess progress towards MDG 1. The target to reduce by half the prevalence of underweight children, was not met by the end of the MDG-period in 2015. Unless coherent national strategies and programmatic interventions are urgently put in place and fully supported to ensure well-coordinated and decisive priority actions, any small gain is likely to be reversed.

[9] FAO, WFP and IFAD. 2012. The State of Food Insecurity in the World 2012. Economic growth is necessary but not sufficient to accelerate reduction of hunger and malnutrition. Rome: FAO.
[10] Ibid.

Building on the unfinished business of the MDGs, the 2030 Agenda for Sustainable Development places a high premium on promoting good nutritional status for realizing inclusive development. More specifically, the Sustainable Development Goal (SDG 2) which aims at "ending hunger, achieving food security and improved nutrition and promoting sustainable agriculture" will contribute to the attainment of the other interrelated goals. Thus, Goal 2 should not be seen in isolation from Goals 1 (end hunger), 3 (ensure healthy lives), 4 (ensure inclusive and equitable quality education), 5 (achieve gender equality), 8 (promote sustained, inclusive and sustainable economic growth) and 10 (reduce inequality). Coherent national strategies and well-coordinated programmatic interventions are urgently required to achieve the SDG on nutrition and ensure that small gains are not reversed.

C. Mandate to Advocate for Nutrition in Africa

At the 4th Joint Meeting of the AU Conference of Ministers of Economy and Finance and the ECA Conference of African Ministers of Finance, Planning and Economic Development held in 2011, the African Union (AU) recognized the compelling evidence that vibrant economic growth in Africa has not translated into equitable social progress, particularly with regard to poverty reduction and job creation.

Experience from other regions of the world – most notably Latin America and Asia – confirms that eliminating hunger and thereby achieving food and nutrition security in Africa is not only one of the most urgent needs for reducing vulnerability and enhancing resilience, but also offers the highest returns as an investment in broad social and economic development. This suggests that had more progress been made against hunger in Africa, the continent's recent growth performance would have been even more impressive, with potentially stronger impact on poverty reduction.

Nevertheless, advocating for nutrition investments has been a challenge for development stakeholders. Often, child nutrition is perceived as a long-term investment which will take several years to generate social returns, thus making short-term investments more attractive as priority items in budget allocations. Furthermore, investment in nutrition is often considered in the context of food security and response to emergency hunger situations.

Recognizing these challenges, the African Union Commission (AUC), strongly supported by WFP, NEPAD and other partners, proposed the development of the COHA study at the 5th Joint Meeting of the AU Conference of Ministers of Economy and Finance and the ECA Conference of African Ministers of Finance, Planning and Economic Development in March 2012. The purpose of this multi-country study was to provide strong evidence on the social and economic consequences of child undernutrition, in order to inform, raise awareness, build consensus and catalyse action towards eliminating undernutrition in Africa. As a result , *Resolution 898 (XLV)* [11] *the Cost of Hunger in Africa: Social and Economic Impacts of Child Undernutrition* was adopted, acknowledging the importance of the study and recommending that it continue beyond the initial stage.

"The Conference of Ministers…

Welcomes the multi-country study on the Cost of Hunger in Africa being led by the African Union Commission and the Economic Commission for Africa, in collaboration with the World Food Programme, to quantify the aggregate social and economic impacts of chronic hunger in Africa;

Anticipates that the study will lead to increased understanding among key national and regional policymakers of the depth and breadth of child undernutrition on the continent, and its aggregate social and economic consequences, and thereby establish a firmer foundation for policies and investments to cut hunger in Africa; and

[Requests partners] to expedite the successful completion of the study, including wide dissemination of the results at country and regional levels."

Extract from Resolution 898 (XLV) the Cost of Hunger in Africa: Social and Economic Impacts of Child Undernutrition

This gave a clear mandate for the AUC to integrate the COHA study into the advocacy efforts of the ARNS (2005-2015) [12] and use the results of the study as a tool to mainstream nutrition in the development process. The resolution also promoted dialogue with political actors at country level, raised the profile of nutrition issues in the economic and planning sectors, and repositioned child nutrition in the context of sustainable economic development. This report is the result of the commitment by the AUC, NEPAD, ECA, WFP and other partners to highlight the tangible consequences of child undernutrition in Africa.

[11] Resolution 898: The Cost of Hunger in Africa: Social and Economic Impacts of Child Undernutrition," in Report of the Committee of Experts of The Fifth Joint Annual Meetings of the AU Conference of Ministers of Economy and Finance and ECA Conference of African Ministers of Finance, Planning and Economic Development (Addis Ababa: African Union, 2012), pg. 15, http://www.uneca.org/sites/default/files/uploaded-documents/COM/com2012/com2012-reportcommittee-of-experts_en.pdf.

[12] African Regional Nutrition Strategy: 2005-2015, report (Addis Ababa: African Union), http://www.who.int/nutrition/topics/African_Nutritional_strategy.pdf

Most recently, the Heads of State and Government of the African Union further reiterated the importance of COHA at the Twenty-Third Ordinary Session of the AU Assembly in Malabo, Equatorial Guinea, from 26 to 27 June 2014, on the theme of the African Year of Agriculture and Food Security: "Transforming Africa's Agriculture for Shared Prosperity and Improved Livelihoods through Harnessing Opportunities for Inclusive Growth and Sustainable Development". In Declaration 4 of the Assembly, titled "Declaration on Nutrition Security for Inclusive Economic Growth and Sustainable Development in Africa", the Heads of State noted with concern the evidence presented by the COHA study that revealed the degree to which child undernutrition influences health and educational outcomes, the additional barrier effect of undernutrition on children's ability to achieve their full potential, and the impact it has on national productivity. They called on member states which had not yet done so, to consider participation in the COHA study and requested the Commission, UNECA, WFP, UNICEF and other development partners to expedite the successful completion of the study, including wide dissemination of the results at country and regional levels.

D. Adapting a Methodology for Africa: a Consultative Process

The model for the COHA study represents a step forward in estimating the social and economic consequences of child undernutrition in Africa. Several efforts have been made to assess the costs of undernutrition globally and in some regions. Notable initiatives at the regional level include those led by ECLAC, carried out jointly with WFP in Latin America and the Caribbean (LAC) and the profiles initiatives[13] which developed similar country-level estimations in selected countries worldwide. The COHA, however, represents the only project designed for Africa, involving nutrition experts from the continent, who provided recommendations during the adaptation process, with the critical support of country teams. The model developed by ECLAC to estimate the social and economic consequences of child undernutrition in LAC [14] presented the most appropriate base on which to develop a model for Africa. In developing the model for LAC, the authors focused on the consequences of child undernutrition from a life-cycle approach, avoiding the potential overlaps with other nutritional deficiencies. This approach proved to be an important political instrument to mobilize stakeholders around nutrition in LAC, and was considered by many to be state-of-the-art knowledge in this field.

The development of the COHA model proved to be a good exercise in South-South collaboration. The two regional UN Economic Commissions, ECLAC and ECA, worked together in a series of joint technical activities and consultations to transfer knowledge and make the adjustments required for accurate adaptation of the LAC model to Africa. An interdivisional working group was created within ECA that included the African Centre for Statistics, the African Centre for Gender and Social Development, and the Economic Development and NEPAD Division. They worked with a number of UN partners – namely, WFP, UNICEF, the International Labour Organization (ILO) and WHO – to ensure multidisciplinary contributions to the development of the model.

At regional level, technical validation of the COHA model was provided by the African Task Force for Food and Nutrition Development (ATFFND). The Task Force, which brings together regional nutrition experts and practitioners, was the ideal body to provide guidance on the development of the model. In consecutive meetings, the ATFFND provided key recommendations, thus laying out a roadmap for the adaptation process, and finally expressed its satisfaction with the proposed COHA model.

To facilitate the implementation of the project, leadership roles were identified: the AUC Department of Social Affairs and the NEPAD Planning and Coordinating Agency led the initiative; ECA/ECLAC coordinated its implementation, while WFP and other partners supported the capacity-building process, both at regional and country levels. Furthermore, the following governing structures were established:

1. The Steering Committee/ATFFND: The high-level Steering Committee was chaired by the AUC and was charged with convening partner organizations, approving the study design and action plan and overseeing the implementation of the study and dissemination of results. The Steering Committee also provided political support to the initiative.

2. The Regional Secretariat: The Regional Secretariat, based at ECA, worked through a small technical team, drawn from ECA, NEPAD, AUC, WFP, ECLAC and other relevant organizations, to support the preparation, implementation and dissemination of the study, as well as to facilitate smooth and high-quality work by the national implementation teams and expert committees. The Secretariat reported to the Steering Committee and managed the study budget.

[13] "FHI 360 Profiles," FHI 360 Profiles, accessed September 27, 2013, http://fhi360profiles.org/.
[14] Rodrigo Martínez and Andrés Fernández, Model for Analysing the Social and Economic Impact of Child Undernutrition in Latin America (Santiago de Chile: Naciones Unidas, CEPAL, Social Development Division, 2007).

3. The National Implementation Team (NIT): The core implementation of the study was carried out by a national team in each participating country, drawn from relevant governmental institutions such as, in the case of Ghana, the Ministry of Health (MOH), Ministry of Education (MOE), Ministry of Gender, Children and Social Protection (MoGSCP), National Development Planning Commission (NDPC), Ministry of Finance (MOF) and the Gahana Statistical Service (GSS). In certain situations, a broader reference group was also created to include other actors and UN agencies, such as WFP, UNICEF and WHO. WFP country offices facilitated the process according to country-specific circumstances and supported the coordination of the NIT as required.

For the initial phase of the project, a number of criteria were agreed upon for selecting the initial countries. The requirements were as follows:

1. Data availability: The availability of at least two recent, nationally representative survey datasets on fertility, family planning, maternal and child health, gender, malaria and nutrition, preferably the Demographic and Health Survey (DHS).).

2. Sub-regional coverage: At least one country selected from each AU region: Community of Sahel-Saharan States (CEN-SAD), Common Market for Eastern and Southern Africa (COMESA), Economic Community of Central African States (ECCAS), Economic Community of Western African States (ECOWAS), Intergovernmental Authority for Development (IGAD), Southern African Development Community (SADC) and Union du Maghreb Arabe (UMA). Overlapping membership of regional economic communities was also taken into account in the final selection of countries.

3. Socio-economic representation: Prevalence of poverty and under-nourishment in the overall population and occurrence of episodes of drought or other natural disasters.

4. Existence of a national platform on malnutrition and hunger.

Based on these criteria, 12 initial countries were selected (Table 1.3). Four of them, namely Egypt, Ethiopia, Swaziland and Uganda, participated as first-phase countries. Contributions from the NITs in these countries helped in the adaptation of the model. Four countries were in the second phase: Burkina Faso, Ghana, Malawi and Rwanda. Another four countries have been selected for the third phase: Botswana, Cameroon, Kenya and Mauritania.

TABLE 1.3: COUNTRY SELECTION CRITERIA

Country	AU Region	Data availability (Survey Dates)[a]	Proportion of under-nourished in total pop. (%)[b]	Crude birth rate (births per 1,000 pop.)[c]	<5 mortality rate, (per 1,000 live births)[d]	UN HDI value ranking[e]	Prevalence of Stunting in children <5 years[f]
Botswana	SADEC	# CSO/UNICEF.	27.9	24	48	118	31[g]
Burkina Faso	ECOWAS	2010, 2003, 1998-99 Standard DHS	25.9	41	102	181	34.6
Cameroon	ECCAS	2004, 1998, 1991 Standard DHS	15.7	38	97	150	32.5
Egypt	CEN-SAD, COMESA	2008, 2005, 2000 Standard DHS	<5	24	22	113	28.9
Ethiopia	IGAD, COMESA	2010, 2005, 2000 Standard DHS	40.2	34	68	174	44.4
Ghana	ECOWAS	2008, 2006, 1998 Standard DHS, 2011, 2006 MICS	<5	31	80	135	28.0
Kenya	IGAD, COMESA	2008-09, 2003, 1998 Standard DHS	30.4	36	73	143	35.3
Malawi	SADC, COMESA	2010, 2004, 2000 Standard DHS	23.1	40	71	171	47.1
Mauritania	UMA	2003-04 Special 2000-01 Standard DHS	…	34	93	159	23[g]
Rwanda	COMESA	2010, 2005, 2000 Standard DHS	28.9	36	55	166	44.2
Swaziland	SADC, COMESA	2006-07 Standard DHS, 2002 MICS	…	30	82	140	28.9
Uganda	IGAD, COMESA	2010 Standard AIS, 2006, 2000-01 Standard DHS	34.6	44	69	161	33.4

a/MEASURE DHS - Quality information to plan, monitor and improve population, health, and nutrition programs," MEASURE DHS, accessed December 26, 2014, http://www.measuredhs.com/.
b/The state of food insecurity in the world, Report, FAO, Rome, 2012, http://www.fao.org/docrep/016/i3027e/i3027e00.htm
c/"Birth rate, crude (per 1,000 people)," Data, World Bank, accessed December 26, 2014, http://data.worldbank.org/indicator/SP.DYN.CBRT.IN.
d/"Mortality rate, under-5 (per 1,000 live births)," Data, World Bank, accessed December 26, 2014, http://data.worldbank.org/indicator/SH.DYN.MORT.
e/Human Development Report 2011, Report, UNDP, New York, 2011, http://hdr.undp.org/en/content/human-development-report-2011/.
f/"MEASURE DHS - Quality information to plan, monitor and improve population, health, and nutrition programs," MEASURE DHS, accessed December 26, 2014, http://www.measuredhs.com/.
g/ The State of the World's Children 2013, "UNICEF Statistics, accessed December 26, 2014,http://www.unicef.org/sowc2013/statistics.html

E. Guiding Principles

Throughout the adaptation, implementation and utilization of the COHA model, four guiding principles were developed. With the overall goal of improving the nutritional situation in Africa, these principles allowed the team to approach the study and the necessary steps for its implementation in a holistic manner. The four guiding principles are as follows:

A. National ownership of the process

The project engages regional experts and policy makers as the main actors of the process. To this end, a feasibility workshop was carried out in the early stages of the process, bringing together practitioners across various sectors in order to analyse the challenges ahead and jointly produce a roadmap. Representatives from the 12 initial countries and key partners met to assess the process ahead and provided key recommendations for the adaptation of the ECLAC model. Some of these elements included capacity building, strong communication strategies and synergies with other on-going costing initiatives.

As a result of this feasibility workshop, NITs were established in each of the four first-phase countries, and initial training on the model and data requirements was carried out. A key milestone of the adaptation process was a regional technical meeting held in Entebbe, Uganda, where NITs presented a series of specific recommendations for the process based on national constraints and lessons learned. This feedback allowed the Regional Secretariat to develop a final roadmap for methodological adaptation, adjust the data collection instruments and develop a final proposal for the COHA model for Africa.

B. Building national capacity to advocate for child nutrition

A second guiding principle for COHA is to ensure that national capacity is strengthened during the implementation of the study. Similar costing initiatives have had limited impact due, in part, to the lack of national ownership and limited understanding by the stakeholders of the technical aspects of the study. These elements hinder the national stakeholders' capacities to effectively communicate the results, which could limit the policy impact of the study.

The main implementing actors of COHA in each country are specialists from key government institutions, academics and practitioners, often led by the economy and/or planning ministry or the Ministry of Health. Once a team of eight to ten specialists is established, a training workshop is held to review all technical aspects of the model, form a task force for data collection and develop an initial communication strategy. In this workshop, a work plan is developed by the NIT that serves as a guideline for future activities.

The Regional Secretariat supported the capacity-building process of the NITs by holding regular teleconferences with representatives from each team and by providing technical assistance in the analysis of data and initial results. National ownership of the study is emphasized by creating an NIT-led approach and by relying on nationally validated information. Once a country report is drafted, a national validation workshop of the results is held by the NIT and specific advocacy documents are prepared for key stakeholders.

One of the advantages of this process is the integration of COHA by the NITs in their national nutritional strategies. This has been possible as the actors participating in the study are often the same professionals shaping national nutritional strategies. This ensures alignment of the processes and maximizes the potential contribution and sustainability of the initiative.

C. Engagement of COHA with global nutrition initiatives and movements

The third guiding principle for COHA is to generate synergies with partners and global initiatives in order to maximize contributions. To achieve this, strong efforts were made to link COHA with relevant initiatives that contribute to reducing child undernutrition.

The Scaling Up Nutrition (SUN) Movement was launched in 2010 and includes selected countries with high burdens of malnutrition. The purpose of the Movement is as follows:

It unites people – governments, civil society, the United Nations, donors, businesses and scientists – in a collective effort to improve nutrition. The Movement recognizes that good nutrition in the 1,000 days of a mother's pregnancy until her child's second birthday is an essential requirement and right for each world citizen to earn, learn, stay healthy and achieve his or her lifetime potential. The SUN Movement is founded on the compelling evidence that investment in nutrition yields major economic returns.45

COHA contributes to the SUN Movement by presenting strong arguments for investing in child nutrition in specific country contexts. This has helped countries to make some improvements in the nutritional situation of their populations.

Another important global actor in the nutrition context is the Renewed Efforts against Child Hunger (REACH) initiative. This joint initiative of UN agencies, WFP, WHO, UNICEF and FAO provides technical assistance to governments developing plans and strategies to scale up nutrition investments. An important part of their advocacy at country level includes engaging non-traditional actors in discussions on nutrition in order to mainstream nutrition in their planning and activities. COHA also represents an opportunity for collaboration, as it provides strong evidence on the consequences of stunting in educational performance, the loss of working hours by working age population and the loss in manual and non-manual productivity, thus helping to reposition nutrition on the wider development agenda. REACH facilitators are also typically members of the NIT in countries where REACH is present.

D. Strategic advocacy for change

The fourth guiding principle of COHA is to ensure that the results reach key stakeholders with the capacity to make a change. The communication strategy of COHA is a basic component of the project. It requires that strong efforts are made by each NIT to reach decision makers with the appropriate information in order to increase their interest in and understanding of the consequences of child undernutrition. In this regard, a six-step approach has been developed:

1. Familiarize the team with the problems contributing to undernutrition and proven nutrition interventions;
2. Identify and categorize key actors;
3. evelop objectives for each actor;
4. Produce information materials and brief stakeholders;
5. Adapt results and present them to target decision-makers; and
6. Follow up and provide support.

Each NIT is provided detailed information on these six steps. Additionally, the NIT holds communication and advocacy sessions at each of the technical workshops to discuss implementation of the six-step approach.

WFP/Nyani Quarmyne

Section II

Cost of Hunger in Africa Methodology

Cost of Hunger in Africa Methodology

A. 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 nutritionally adequate food.

DEFINITION OF TERMS FOR COHA MODEL

1. Chronic Hunger: The status of people, whose food intake regularly provides less than their minimum energy requirements leading to undernutrition.[15]

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. [16]

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). [17]

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.[18]

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.[19]

Nutrition security, therefore, depends on a person's food security or insecurity. Specifically, nutrition security can be described as the "appropriate quantity and combination of food, nutrition, health services and caretaker's time needed to ensure adequate nutrition status for an active and healthy life at all times for all people."[20]

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. Furthermore, 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 are different for each stage.[21]-

15 "Hunger statistics", FAO Hunger Portal, Undernourishment or Chronic Hunger, FAO, accessed March 14, 2013, http://www.fao.org/hunger/ en/.
16 Ibid
17 Ibid
18 Ibid
19 WFP, VAM Standard analytical framework, World Food Programme, 2002.
20 USAID, USAID Commodities reference guide, Annex I: Definitions, January 2006, http://transition.usaid.gov/our_work/humanitarian_assistance/ ffp/crg/annex-I.htm.
21 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.

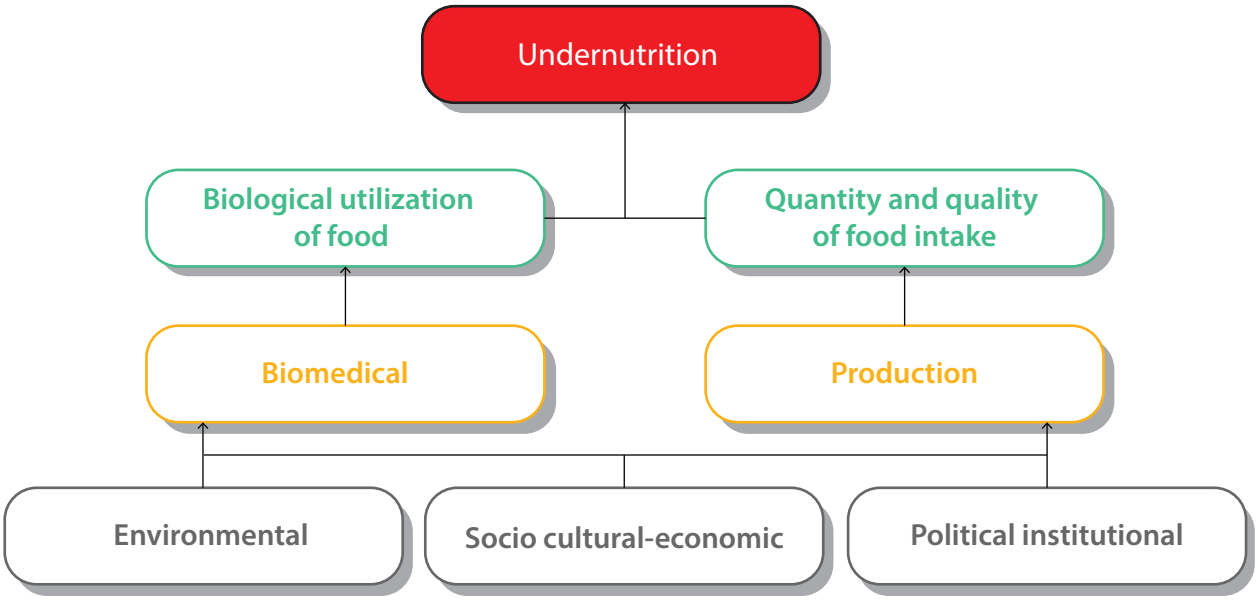
Below is a discussion of the central elements considered in the model to estimate the effects and costs of child undernutrition based on the concepts presented above, along with a brief description of the causes and consequences of undernutrition. The discussion also describes the dimension of analysis and the principal methodological aspects used to interpret the results.[22]

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.[23]

Each of these factors helps increase or decrease the likelihood of a person to suffer from undernutrition (Figure 2.1). 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 2.1: CAUSES OF UNDERNUTRTION



Source: Modified from 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.

One of the key considerations in assessing undernutrition is the environment. Environmental factors define the surroundings in which the subject and his or her family live, including the risks arising 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.

Another key factor in the analysis relates to production. Production factors have been directly associated with food output in Africa, but an important element of this dimension is the unequal access to food that people living in social, environmental and economic vulnerability have. 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 and hence access to food and nutrition.

[22] A summarized version of the theoretical background and the basic characteristics considered in the model of analysis are presented here. 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, NacionesUnidas, CEPAL, Social Development Division, Santiago De Chile, 2007.

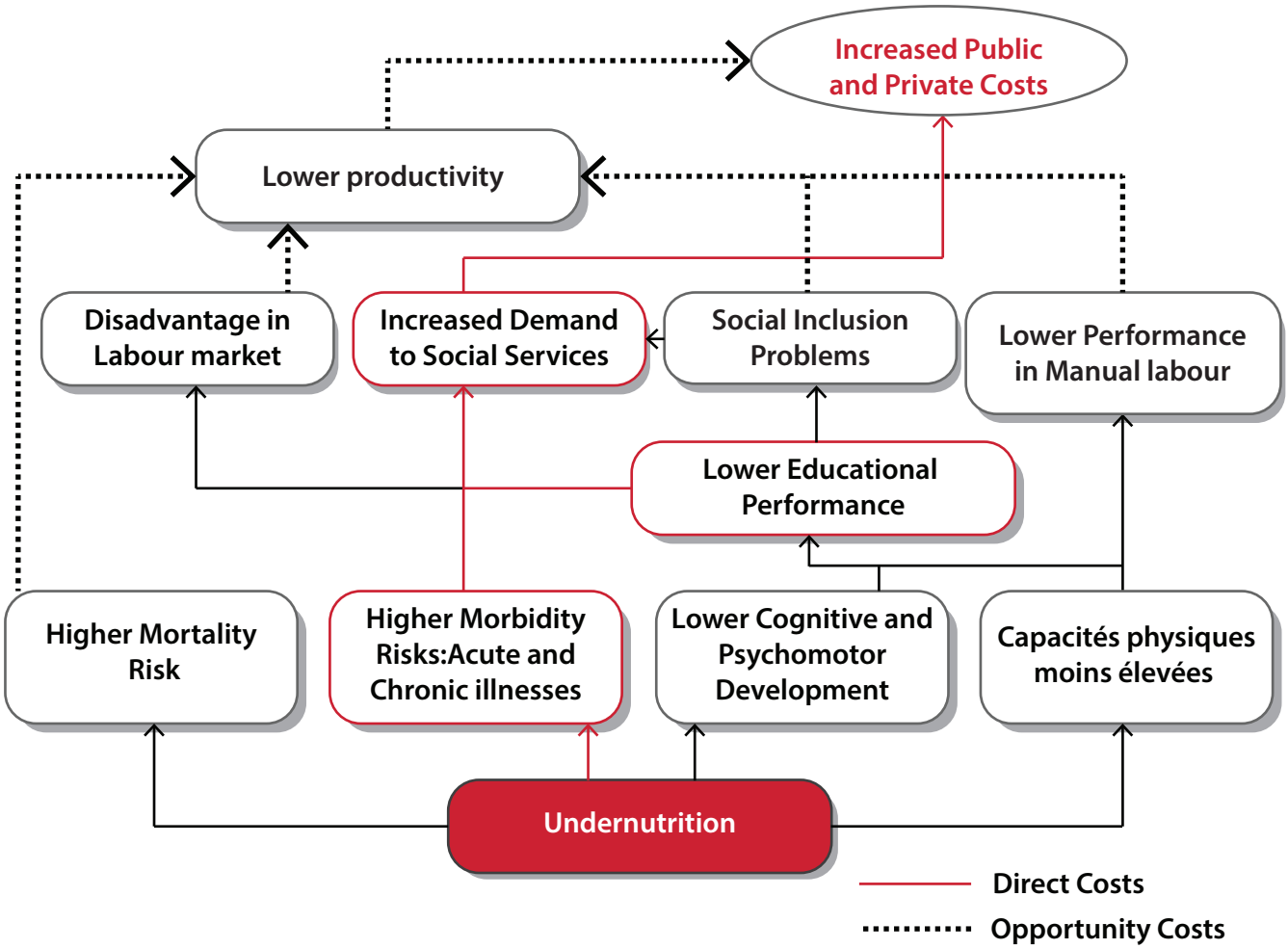
[23] Rodrigo Martínez and Andrés Fernández, Model for analysing the social and economic impact of child undernutrition in Latin America, Naciones Unidas, CEPAL, Social Development Division, Santiago de Chile, 2007.

Finally, the analysis is also based on biomedical factors. The analysis based on these factors provides the opportunity for an in-depth analysis of the individual's susceptibility to undernutrition, insofar as deficiencies in certain elements limit the capacity to make efficient biological use of the food consumed (regardless of quantity and quality).

III. Consequences of undernutrition

Child undernutrition has long-term negative effects on a person's life[24], most notably in the aspects of health, education, and productivity (Figure 2.2). These elements are quantifiable as expenditure and costs to both the public sector and to individuals. Consequently, these effects exacerbate problems in social integration and increase or intensify poverty. A vicious cycle is perpetuated as vulnerability to undernutrition grows.

FIGURE 2.2: 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.

Undernutrition may have immediate or evolving impact throughout a person's lifetime and 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 incidence or intensified severity of specific pathologies, and increases the chance of death during specific stages of the life cycle.[25] 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[26] This translates into a greater probability of starting school at a later age, repeating grades, dropping out of school, and ultimately attaining a lower level of education.

[24] Alderman H., et al., "Long-term consequences of early childhood malnutrition", FCND Discussion Paper No. 168, IFPRI, 2003.
[25] 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,
[26] 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.[27]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 overall reduced body mass when compared to full adult potential.

Undernutrition and each of its negative impacts on health, education and productivity, as described above, lead to a social as well as an economic loss to the individual and society as a whole (Figure 3.2). Thus, the total cost of undernutrition (TC^U) is a function of higher healthcare spending (HC^U), inefficiencies in education (EC^U) and lower productivity (PC^U). As a result, to account for the total cost of undernutrition (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 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 savings scenarios based on prospective interventions to control or eradicate the problem.

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

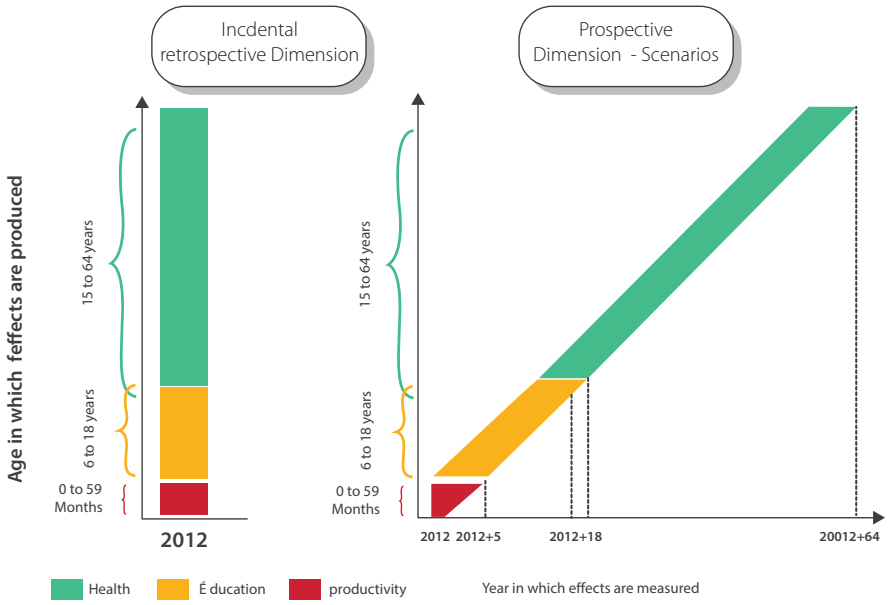
1. Incidental retrospective dimension. This dimension focuses on the population in the study year, including mortality cases of those who would have been alive in the study year. The retrospective dimension estimates the nutritional situation of individuals under the age of 5 to identify the related 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 of working-age individuals who were exposed to undernutrition before the age of five.

[27] 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.

2. Prospective or potential savings dimension. This dimension focuses on children under 5 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 2.3, 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 2.3: 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.

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.[28] 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 is 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, and for the period until age 5, the indicator used as proxy for children suffering from undernutrition is underweight (weight-for-age). For the pre-school stage, after the child turns 6, 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 purposes[29].

[28] 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.

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

For losses in productivity in the working age population, the model continues to use height-for-age as a proxy for the lifelong consequences of childhood undernutrition.

Estimates of the impact 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 the risk run by 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.

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 different cohorts of the population. In the prospective-savings 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. Care has been taken 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 purposes of the research presented in this report.

WFP/Nyani Quarmyne

III Section

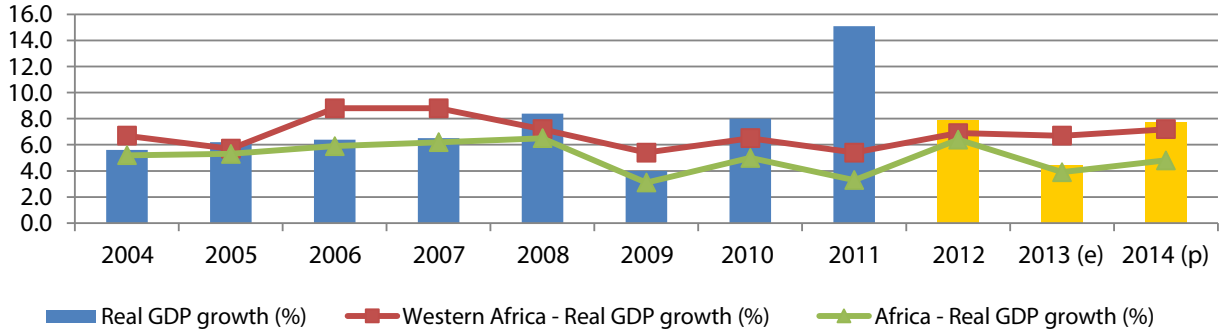
Brief Socio Economic Background

Brief Socio-Economic and Nutritional Background

Ghana is a country in West Africa with a population of about 25 million people. It is the second largest economy in the region after Nigeria. Ghana has a GDP estimated at GH¢93.461billion[30](US$47.9 billion in 2012) and a per capita gross national income (GNI) of approximately US$1,580, which has grown considerably in the last decade. In 2012, approximately 51.8 percent of the population was living on less than US$2 a day and 28.6 percent was living on less than US$1.25 a day.

However, economic growth has averaged more than 6 percent annually since 2006 which has made the country one of the few in Africa to meet the MDG of halving the poverty rate by 2015. Growth has been broad based, driven largely by services and industry, which on average have been growing at a rate of 9.0 percent over the five years to 2013. In 2014, the economy registered sustained economic growth, bolstered by increased oil and gas production, privatesector investment, improved public infrastructure development and sustained political stability (African Economic Outlook, Ghana 2014, p. 2).

FIGURE 3.1: TRENDS IN REAL GDP GROWTH (%), 2003-2013



Source: "World Development Indicators, The World Bank (2012)" and African Economic Outlook for West Africa, accessed on November 2014. Figures for 2013 and later are estimations/projections.

Despite significant growth and improvements in the quality of life, Ghana faces persistent development challenges that must be addressed. . These includes high levels of inequality and high burden of disease, especially malaria, and high micro-nutrient deficiencies. On a broader front, there are limited private sector employment opportunities while climate change threatens to aggravate current challenges in agriculture in general, and food and water supplies in particular.[31] Nevertheless, Ghana was one of the 10 countries in Africa with the biggest improvement in food security since 1990 , according to the Global Hunger Index[32].

30 Ministry of Finance and Economic Planning 2012
31 USAID/GHANA Country Development Cooperation Strategy 2013-2017
32 IFPRI Global Hunger Index, 2014

TABLE 3.1: SOCIO-ECONOMIC-INDICATORS

Indicators	2000-2002	2005-2007	2010-2012
Total population (millions)	19.7	22.5	25.4
GDP (US$ billions)	6.166	24.757	47.928
GNI per capita (Atlas method; current US$)	340	820	1,580
Poverty headcount ratio at national poverty line (% of the population)	…	31.9 (2006)	24.2
GINI Index	…	42.8	42.8
Unemployment, % of total labour force	9.8	3.6	3.6
Unemployment, youth total (% of total labour force aged 16-24)	15.85	6.4	6.4
Population growth (annual %)	2.5	2.6	2.2
Life expectancy at birth, total (years)	57	60	61

Source: African Economic Outlook 2014 and World Development Indicators of the World Bank, 2014

Ghana reports low unemployment, with only 3.6 percent of people reported as being unemployed and 6.4 percent of youth aged16-24 years in 2012[33]. However, the majority of the youth are employed in the informal sector characterized by low productivity, low earnings and lack of social protection.

Public investment in the social sector has been maintained in the last decade, but while public spending on education is above the average for sub-Saharan Africa, health expenditure is below the average. Public spending on education is estimated at 8.1 percent, almost double the regional average of 4.3 percent. Health expenditures are 5.3 percent of the GDP compared to 6.5 percent for the rest of the region[34].

TABLE 3.2: SOCIAL INVESTMENT INDICATORS

Indicators	2000-2001	2005-2006	2010-2011	Sub-Saharan Africa*
Public spending on education, total (% of gov. exp.)	16.6	24.2	33.1	18.1
Public spending on education, total (% of GDP)	5.4	5.3	8.1	4.3
Health expenditure per capita (current US$)	15	48	83	96.2
Health expenditure, total (% of GDP)	5.6	5.4	5.3	6.5
Health expenditure, public (% of total health expenditure)	56.8	57.2	55.9	43.9

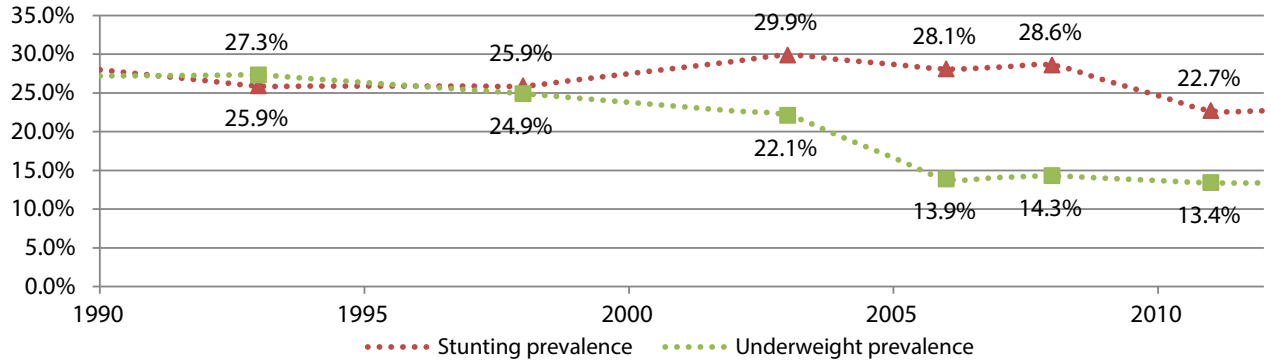
Source: World Bank, World Development Indicators, various years

[33] World Bank
[34] World Bank, World Development Indicators

A. Nutritional Status in Ghana

According to the 2011 Multiple Indicator Cluster Survey (MICS, 2011), approximately 23 percent of Ghanaian children under the age of 5 were suffering from low height for their age (stunting), which is a slight reduction from the 28 percent reported by the 2008 Ghana Demographic and Health Survey. The prevalence of underweight children has also marginally improved from 14 percent to 13 percent. During the same period, the incidence of low birth weight has remained steady at around 10 percent.

FIGURE 3.2: ESTIMATED UNDERNUTRITION TRENDS IN CHILDREN UNDER-5, 1990-2011



Source: Constructed by authors based on MICS 2011, GDHS 2008 and GDHS 2003. Data prior to 2006 have been updated in line with new Child Growth Standards16 introduced by WHO in 2006 to replace the 1977 International Growth Reference, formulated by the National Centre for Health Statistics (NCHS) of WHO

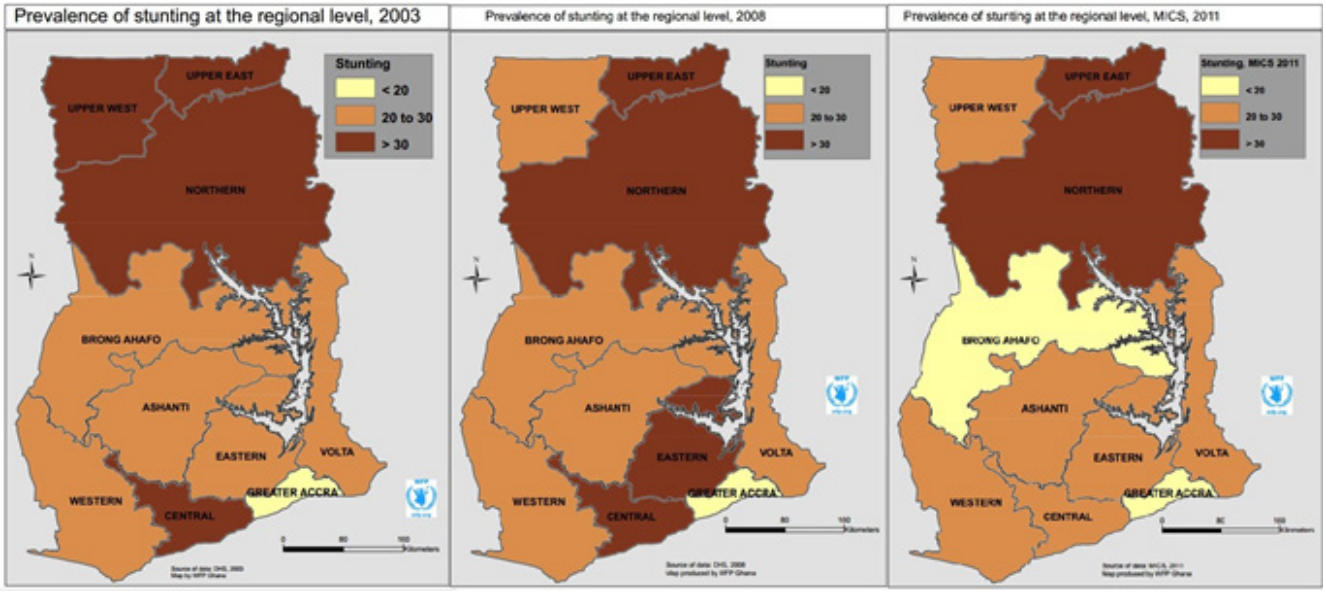
When analysing the progress at sub-national level, it is evident that the policies and responses to child under nutrition have been more effective in certain regions than others. As shown in Table 3.3, for the period from 2003 to 2011, the highest rates of reduction were experienced in the Brong Ahafo Region, where the prevalence of child stunting was reduced by almost 10 percentage points, from 29.4 percent in 2003 to 19.3 percent in 2011. This represents an average rate reduction of 1.26 annually. Also the Upper West region has showed a significant change where the prevalence was reduced by 11 percentage points, from 34.1 percent in 2003 to 23.1 in 2011; which represents an average rate reduction of 1.38 annually. On the other hand the regions that have not showed a considerable reduction compared to the others are Upper East region and Greater Accra. As showed in Table 3.3 in some regions the reduction in the prevalence of child stunting has not been as consistent as it should have been. consistent (Table 3.3). As a step forward, it is important to review current policies and programmes in order to scale up and replicate those that have succeeded in other regions and in countries with similar conditions and challenges

TABLE 3.3: TENDENCIES IN CHILDHOOD STUNTING, BY REGION, 2000-2011 (%)

Region	2003	2008	2011	Proportional Reduction (%)2003-2011	Reduction in Percentage Points	Annual average Rate of Reduction[a]
Ashanti	29.1	26.5	21.7	25.4	7.4	0.93
Brong Ahafo	29.4	25.2	19.3	34.4	10.1	1.26
Central	31.6	33.7	23.1	26.9	8.5	1.06
Eastern	27.4	37.9	21.3	22.3	6.1	0.76
Greater Accra	13.9	14.2	13.7	1.4	0.2	0.03
Northern	48.8	32.4	37.4	23.4	11.4	1.43
Upper East	31.7	36.0	31.5	0.63	0.2	0.03
Upper West	34.1	24.6	23.1	32.3	11	1.38
Volta	23.3	26.8	22.2	4.7	1.1	0.14
Western	28.4	27	22.6	20.4	5.8	0.73
National	**29.9**	**28.0**	**22.7**	**24.08**	**7.2**	**0.90**

Source: Prepared by COHA based on MICS 2011, DHS 2008 and DHS 2003. Data prior to 2006 has been updated in line with new Child Growth Standards introduced by WHO in 2006 to replace the 1977 International Growth Reference, formulated by the National Center for Health Statistics (NCHS).
a/ The Annual average Rate of Reduction is estimated based on a 8 year period considering the values of 2003 and 2011.

FIGURE 3.3:TENDENCIES IN CHILDHOOD STUNTING, BY REGION



The current levels of child undernutrition illustrate the continuing challenges for the reduction of child hunger. It is estimated that 827,533 of the 3.631million children under the age of 5 in Ghana were affected by stunting in 2012 and almost 486,476 children were underweight. This situation is especially critical for children between 12 and 23 months, where 26.5 percent and 16.5 percent of children are affected by stunting and underweight respectively.

TABLE 3.4: POPULATION AND CHILD UNDERNUTRITION, 2012

Age groups	Population size	Low Birth Weight		Underweight		Stunting	
		Population affected	Prevalence	Population affected	Underweight	Population affected	Stunting prevalence
Newborn (IUGR)[a]		72,353	9.7%				
0 to 11 months	745,134			81,949	11.0%	74,691	10.0%
12 to 23 months	736,302			121,490	16.5%	195,120	26.5%
24 to 59 months	2,150,148			283,038	13.2%	557,722	25.9%
Total	**3,631,584**	**72,353**	**9.7%**	**486,477**	**13.4%**	**827,533**	**22.7%**

Source: Calculated based on MICS, 2011 and African Centre for Statistcs, ECA and Ghana Statistical Service (GSS).
a./ In a given year, the newborn population is the same as the 0-11 months age group.

WFP/Nyani Quarmyne

Section IV

Effects and Costs of Child Undernutrition

Effects and Costs of Child Undernutrition

Undernutrition is mainly characterized by **wasting** (low weight-for-height), **stunting** (low height-for-age) and **underweight** (low weight-for-age). From 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.[35] 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 higher risk of mortality.[36] At school, stunted children are more likely to repeat grades and drop out[37], thus reducing their income-earning capability later in life.[38] Furthermore, adults who were stunted as children are less likely to achieve their expected physical and cognitive development, thereby reducing their productivity. [39]

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[40]. 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 diarrhoeal syndrome (ADS), and fever/malaria associated with undernutrition in children under the age of 5.

I. Effects on morbidity

Undernourished children are more susceptible to recurring illness[41]. Based on the differential probability analysis undertaken using DHS data in Ghana, underweight children under 5 years have a 7.5 percent increased risk of anaemia, 8.2 percent increased risk of diarrhoea, a 2.6 percent increased risk of acute respiratory infections, and a 2.9 percent increased risk of fever/malaria.

The study estimated that as a consequence of this incremental risk, in 2012 there were 236,256 incremental episodes of illness from diseases associated with underweight in Ghana (Table 4.1). The highest proportion of all incremental illnesses (48 percent) is associated with diarrhoea, followed by acute respiratory infections (22 percent). In addition, pathologies related to calorie and protein deficiencies and low birth weight associated with intrauterine growth restriction (IUGR), totalled 1,092,424 episodes in 2012. As a consequence, Ghana had to address 1,328,680 illnesses in children that required medical attention and generated costs both to families and to the health sector.

35 Ramachandran P. and Gopalan H., "Undernutrition & risk of infections in preschool children", Indian J Med Res 130, November 2009, pp. 579-583
36 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
37 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
38 H. Alderman, "Long-Term Consequences of Early Childhood Malnutrition," Oxford Economic Papers 58, no. 3 (May 03, 2006), doi:10.1093/oep /gpl008
39 Idem
40 Ramachandran P. and Gopalan H., "Undernutrition & risk of infections in preschool children", Indian J Med Res 130, November 2009, pp. 579-583
41 Idem

TABLE 4.1: MORBIDITIES FOR CHILDREN UNDER-5 ASSOCIATED WITH UNDERWEIGHT, BY PATHOLOGY, 2012

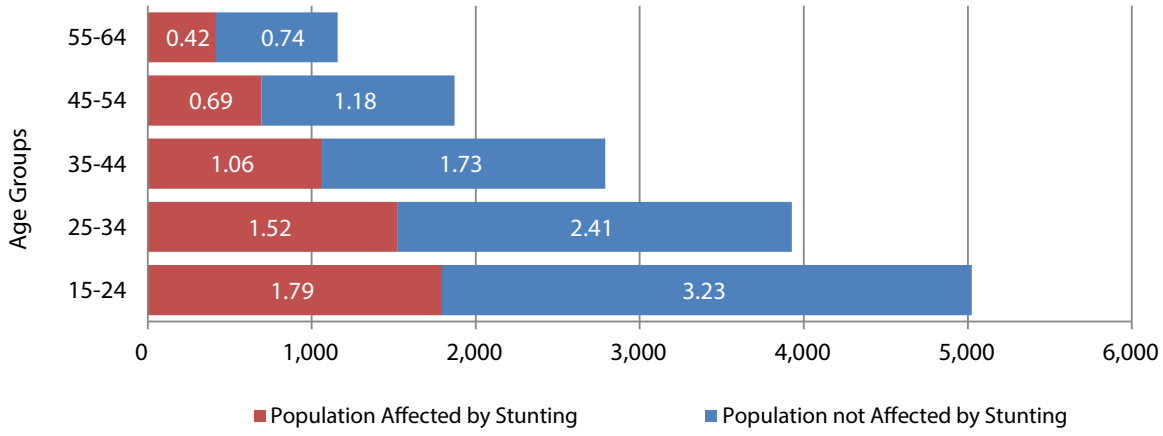
Pathology	Number of episodes	Percentage of episodes
Anaemia	33,303	14%
Acute Diarrhoeal Syndrome	112,644	48%
Acute Respiratory Infections	51,911	22%
Malaria	38,399	16%
Subtotal	236,256	
Low birth weight	37,521	3%
Underweight	1,054,902	97%
Subtotal	1,092,424	
Total	**1,328,680**	...

Source: Model estimations based on Ghana DHS 2008, MICS 2011, and demographic information from GSS

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[42]. Ghana has made progress in reducing stunting in children to moderate levels. However, the high stunting rates of the past remain a burden for an important percentage of the population. As illustrated in Figure 4.1, the model estimates that 5.488 million adults in the working-age population suffered from growth retardation before reaching 5 years of age. In 2012, this represented 37 percent of the population aged 15-64 who were in a disadvantaged position as compared to those who were not undernourished as children. This is particularly important for the group aged 15-24 where almost 1.8 million of the current young population of the country suffered from childhood stunting.

FIGURE 4.1: WORKING-AGE POPULATION AFFECTED BY CHILDHOOD STUNTING, BY AGE *(millions of people)*



Source: Model estimations based on demographic information from GLSS6, GSS 2012/13

[42] Idem.

III. Effects on mortality

Child undernutrition can lead to increased incidence of mortality – most often associated with episodes of diarrhoea, pneumonia and malaria[43] Nevertheless, when the cause of death is determined, it is rarely attributed to the nutritional deficit of the child, but rather to the related illnesses. Given this limitation in attribution, the model utilizes relative risk factors[44] to estimate the risk of increased child mortality as a result of undernutrition. Mortality risk associated with undernutrition was calculated using these relative risk factors, historical survival and mortality rates,[45]as well as historical nutrition information.

Between 2008 and 2012, it is estimated that 71,711 child deaths in Ghana were directly associated with undernutrition. These deaths represent 23.8 percent of all child mortalities for this period. Thus, it is evident that undernutrition significantly exacerbates the rates of death among children in the country.

TABLE 4.2: IMPACT OF UNDERNUTRITION ON CHILD MORTALITY, ADJUSTED BY SURVIVAL RATE, 1948-2012 ***(In number of child mortalities)***

Period	Number of child mortalities associated to undernutrition
1948-1997	1,077,906
1998-2007	186,652
2008-2012	71,711
Total	**1,336,270**

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

These historical mortality rates will also have an impact on national productivity. The model estimates that an equivalent of 7.3 percent of the current workforce has been lost due to the contribution of undernutrition to child mortality rates. This represents 1,077,906 people who would be between 15-64 years old, and part of the working-age population of the country.

IV. Public and private health costs of undernutrition

The treatment of undernutrition and related illnesses is a critical recurrent cost for the health system. Treating a severely underweight child, for example, requires a comprehensive protocol[46]. for a condition that can often be prevented with appropriate nutrition-sensitive actions. The economic cost of each episode can be increased by inefficiencies when such episodes are treated without proper guidance from a healthcare professional or due to lack of access to proper health services. These costs represent an important burden for not just the public sector but for society as a whole.

In the section 'Effects on morbidity' above, it is estimated that 1,328,680 clinical episodes in 2012 in Ghana were associated with the incremental risk to illness associated with children being underweight. Each of these episodes required a specific protocol for treatment that included medicines and medical care costs, in addition to the costs incurred by caretakers providing the treatment. The data collection process generated cost estimations for in-patient and out-patient treatment of each of the pathologies, namely anaemia, ADS, ARI, malaria/fever, as well as costs of therapeutic treatment of underweight children and low birth weight in children, as described in detail in Annex 2.

By aggregating each individual cost associated with specific pathologies by the number of incremental episodes given by the risk associated with underweight children as indicated in Table 4.3, these episodes generated an estimated cost of GH¢357.8 million.

43 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
44 Idem
45 Data provided by the UN Population Division, http://www.un.org/esa/population/unpop.htm
46 WHO, Management of severe malnutrition: a manual for physicians and other senior health workers ISBN 92 4 154511 9, NLM Classification: WD 101, 1999.

TABLE 4.3: HEALTH COSTS OF UNDERNUTRITION-RELATED PATHOLOGIES, 2012

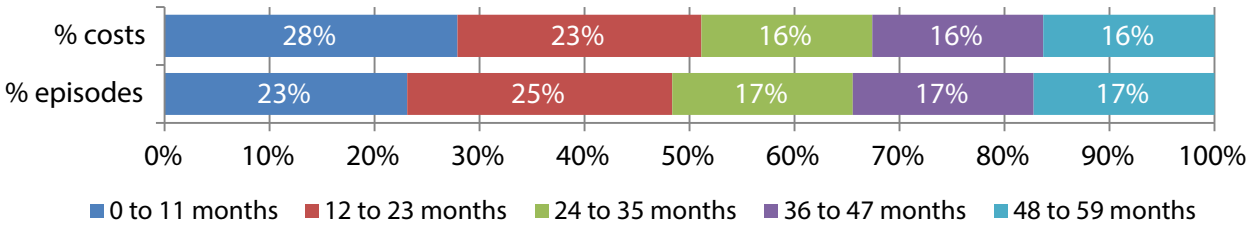
Pathology	% of episodes	*Cost(GH¢ mn)*	*Cost(US$ mn)*	% of cost
Underweight	79.4	313.30	174.46	**88**
Lowbirthweight (IUGR)	2.8	16.14	8.99	5
Anaemia	2.5	3.34	1.86	1
Acutediarrhealsyndrome (ADS)	8.5	18.03	10.04	5
Acuterespiratory infection (ARI)	3.9	3.30	1.84	**0.9**
Fever/Malaria	2.9	3.69	2.05	**1.0**
Total		**357.8**	**199.2**	

Source: Model estimations based on GDHS 2008 and MICS 2011

When analysing the origin of the costs associated with the different pathologies, it is evident that the majority of the costs incurred were connected to the protocol required to bring an underweight child back to proper nutritional status, which often requires therapeutic feeding and special care. However, the treatment of a low birth weight (LBW) child represents the highest per capita cost of all pathologies[47]. These cases represented 2.82 percent of all the episodes but generated 4.51 percent of the total cost. This is due to the special management protocol required by LBW children which often includes hospitalization and time in intensive care.

Another important perspective of this analysis is organizing the information based on specific age groups. As shown in Figure 4.2, children under 12 months generated 23 percent of all episodes associated with undernutrition, which however, represent 28 percent of total costs in the health sector. This result emphasizes the importance of focusing interventions on the prevention of child malnutrition, in accordance with the 1,000 Days campaign[48] and working with mothers before and during pregnancy to ensure that children are born and develop with proper weight and health during this period of rapid growth and development.

FIGURE 4.2: DISTRIBUTION OF INCREMENTAL EPISODES AND COSTS OF ILLNESS ASSOCIATED WITH UNDERNUTRITION BY AGE GROUP



Source: Model estimations based on GDHS 2008, and demographic information from GSS.

Another important element to consider is the distribution of private and public cost of care. The public cost is based on two major elements: the cost of medical inputs such as medicines and tests, and the unit cost per visit for the health system, such as the time of the physicians, and the overhead costs to the medical centre. These costs are separated to avoid duplications, as one episode of any pathology might require several follow-up visits, but only one full set of medical inputs. For the private costs, the main costs considered are transportation to and from the health centre, the opportunity cost of waiting time, and the medical inputs not covered by the system. These costs are also calculated differentially for ambulatory care, and for in-patients that require hospitalization, for each pathology and age group.

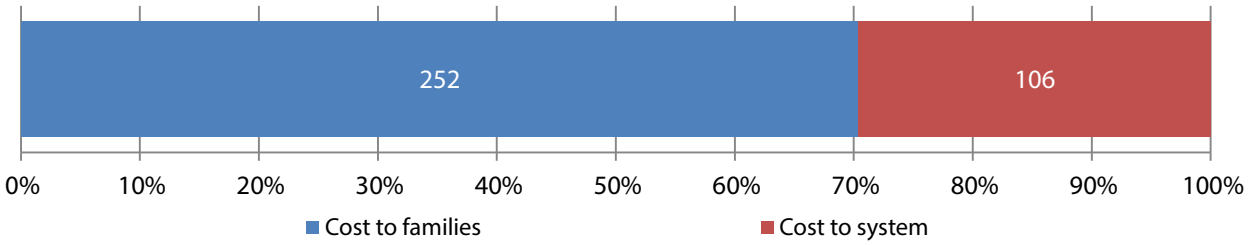
[47] According to primary data collected from health posts and hosptals in Ghana, a child with a LBW requires to stay in the health facility for more number of days than for other pathologies. This ultimately increases the cost of treatment.

[48] The 1,000 Days partnership promotes targeted action and investment to improve nutrition for mothers and children in the 1,000 days between a woman's pregnancy and her child's second birthday when better nutrition can have a life-changing impact on a child's future and help break the cycle of poverty. For more information visit: http://www.thousanddays.org/

The model also takes into account the large proportion of cases that are treated at home and that do not obtain formal health treatment. For this estimation, the model utilizes information based on the MICS and GDHS surveys, complemented by information gathered from field visits to health centres, interviews with experts and information from national health systems. As there is very little information on the actual costs and time allocation of home care for underweight children who present compounding illnesses, a shadow cost equivalent to the per unit treatment cost of each episode is set for the treatment of each pathology, and associated with those cases that did not receive formal medical attention. However, this does not consider the inefficiencies and complications that can arise from non-formal home treatment and might lead to underestimation of the real cost of home care.

Based on information collected by the NIT, the model estimates that only 43 percent of the episodes presented receive proper health care. Figure 4.3 summarizes the institutional (public system) and private costs of treating pathologies associated with undernutrition. In Ghana, it is estimated that families bear around 70 percent of the costs associated with undernutrition, as compared to 30 percent for the public health system.

FIGURE 4.3: DISTRIBUTION OF PRIVATE AND PUBLIC COSTS *(GH¢ mn)*



Source: Source: Model estimations based on GLSS6, DHS surveys and primary data collected by the NIT.

In 2012, the annual cost of undernutrition to the public sector was estimated at 4.1 percent of the total budget allocated to health. At macro level, the economic impact of undernutrition on health was equivalent to 0.49 percent of GDP that year.

B. Social and economic cost of child undernutrition in education

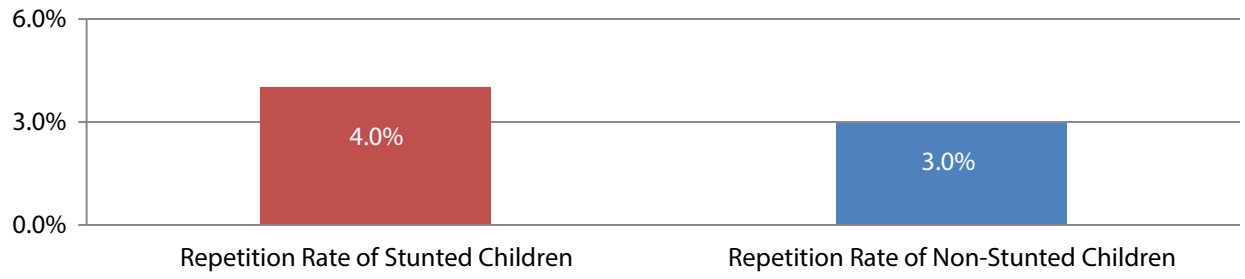
There is no single cause for repetition and dropping out but there is substantive research suggesting that children who were stunted before the age of 5 are more likely to underperform in school[49]. The numbers of repetition and dropout cases considered in this section result from applying a differential risk factor associated with stunted children to official government information on grade repetition and dropouts in 2012. The cost estimations are based on information provided by the Ministry of Education on the average cost for a child to attend primary and secondary school in Ghana in 2012, as well as estimations of costs incurred by families to support schooling.

I. Effects on repetition

Children who suffered from undernutrition before 5 years of age are more likely to repeat grades, as compared to those who were not affected by undernutrition[50]. In Ghana in 2012, net enrolment rates were relatively high, with 81.8 percent enrolment in primary education and 45.7 percent enrolment in secondary education[51] Based on information provided by the Ministry of Education[52] , 160,576 children repeated grades in 2012. Using data on increased risk of repetition among stunted students, the model estimates that the repetition rate for stunted children was 4.0 percent, while the repetition rate for non-stunted children was 3.0 percent, i.e. an incremental differential risk of 1.0 percentage point for stunted children (Figure 4.4). Thus, given the proportion of stunted students, the model estimates that 19,720 students, or 12.3 percent of all repetitions in 2012, were associated with stunting

[49] 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, www.Jn.nutrition.org.
[50] Idem.
[51] UNESCO.(http://www.uis.unesco.org/Pages/default.aspx). May 2014
[52] Ghana. Ministry of Education (Education Management Information System), Education Statistics 2012.

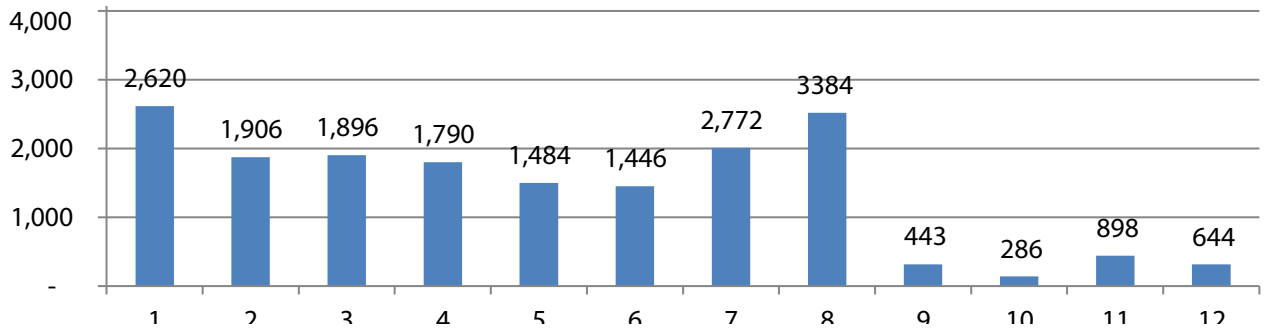
FIGURE 4.4: REPETITION RATES IN EDUCATION, BY NUTRITIONAL STATUS, 2012



Source: Estimations based on data provided by Ministry of Education and relative risk factors.

As shown in Figure 4.5, most of these grade repetitions happen during primary school. There are far fewer children who repeat grades during secondary school, largely due to the fact that many underperforming students drop out of school before secondary level.

FIGURE 4.5: GRADE REPETITION OF STUNTED CHILDREN, BY GRADE, 2012 ***(number of repetitions)***



Source: Estimations based on data from Ministry of Education.

II. Effects on retention

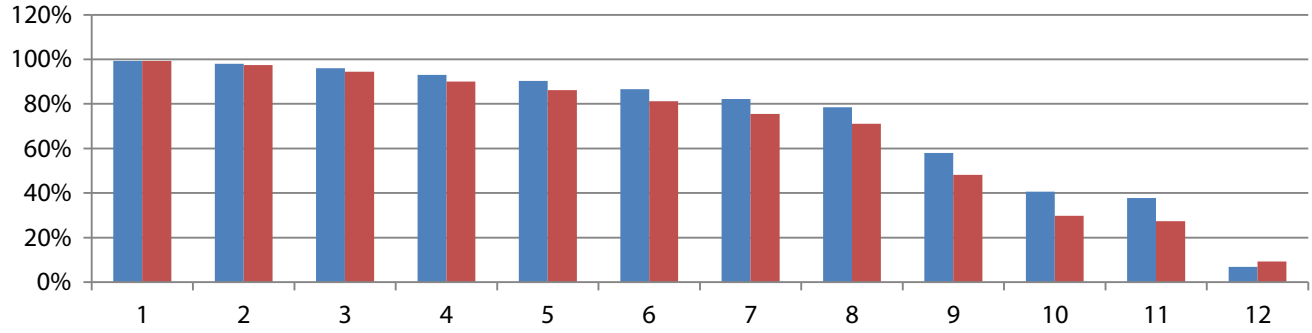
Progressive education is a key driver of human capital, and keeping children longer in school is a key element of inclusive development and economic growth. There are several compounding factors that combine to increase the risk of dropping out of school, both contextual – such as living in poor households, distance to school, school fees, teacher absenteeism – and intrinsic – such as health and motivation[53]. Additionally, the relationship between grade repetition and school desertion has been documented in the literature

According to available data and taking into account the relative risks associated to the consequences of stunting on educational performance, there is an important gap in school completion between those who suffered from stunting as children and those with a healthy childhood. The model estimates that from the current working age population aged 20 to 64, 81 percent of those who were stunted as a child (and presently of working age) completed primary school compared to 87 percent of those who were never stunted[54-55]. In this sense, the incremental risk of repetition, and higher absenteeism associated with children who are stunted also augments the risk of those children dropping out of school.

According to available data and taking into account the relative risks associated with the consequences of stunting on educational performance, there is an important gap in school completion between those who suffered from stunting as children and those with a healthy childhood. The model estimates that of the current working age population aged 20 to 64, about 72 percent of those who were stunted as a child (and are presently of working age) completed primary school compared to 80 percent of those who were never stunted (Figure 4.6)

[53] Colclough, C., Rose, P. and Tembon, M. 2000. "Gender inequalities in primary schooling: The roles of poverty and adverse cultural practice." International Journal of Educational Development 20: 5-27.
[54] UNESCO Institute of Statistics.Global Education Digest 2012. Opportunities Lost: The Impact of Grade Repetition and Early School Leaving. Paris: UNESCO.
[55] Pierre André. "Is grade repetition one of the causes of early school dropout? Evidence from Senegalese primary schools." December 4th 2009.

FIGURE 4.6: GRADE ACHIEVEMENT, BY NUTRITIONAL STATUS, 2012



Source: Estimations based on data from Ministry of Education.

The costs associated with dropping out of school are reflected later in high productivity losses when individuals enter the labour market. As such, the impact is not reflected in the school age population, but in the working-age population. Hence, in order to assess the social and economic costs in 2012, the analysis focuses on the differential in schooling levels achieved by the population who suffered from stunting as children and the schooling levels of the population who were never stunted.

III. Estimation of public and private education costs

Repetition in schooling has direct cost implications for families and the school system. Students who repeat grades generate an incremental cost to the educational system, as they require commensurate additional resources to repeat the year. Their parents or guardians in turn have to pay for an additional year of education.

In 2012, the 19,720 students who repeated grades (and whose repetition is considered to be associated with undernutrition) represented a cost of GH¢23.08 million. The largest proportion of repetitions occurred during primary school, where the cost burden falls mostly on the families. Table 4.4 summarizes the public and private education costs associated with stunting

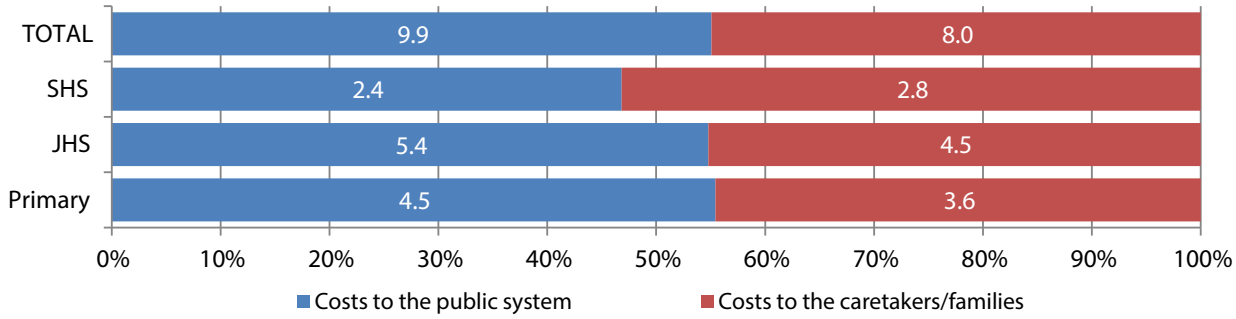
TABLE 4.4: COSTS OF GRADE REPETITION ASSOCIATED WITH STUNTING

	Primary		Junior High School		Senior High School		Total	
	GH¢ mn	US$	In GH¢	In USD	In GH¢	In USD	In GH¢	In USD
Number of repetitions associated with stunting	11,142.46		6,599		1,979		19,720	
Public Costs per student	400	222.7	818	455.5	1,227	683.3		
Total Public Costs (in millions)	4.5	2.5	5.4	3.0	2.4	1.4	12.3	6.8
Private Costs per student	322	179.1	675	375.8	1,393	775.9		
Total Private Costs (in millions)	**3.6**	**2.0**	**4.5**	**2.5**	**2.8**	**1.5**	**10.8**	**6.0**
Total Costs	8.0	4.5	9.9	5.5	5.2	2.9	23.1	12.9
% Social expenditure on education	**0.38%**							

Source: Model estimations based on costing data from the Ministry of Education.

As in the case of health, the social cost of undernutrition in education is also shared between the public sector and families. Of the overall costs, a total of GH¢10,794,395 or (47 percent) is covered by families, while GH¢12, 282,879 (53 percent) is borne by the public education system. Moreover, the distribution of this cost varies depending on whether the child repeated grades in primary, junior high school or senior high school. At primary and JHS education level, families cover 45 percent of the associated costs of repeating a year, whereas at senior high school level, the burden on families rises to 53 percent. The increase on the costs to the families in secondary education is driven by higher spending on educational materials and the higher contribution that families make to tuition fees in secondary education.

FIGURE 4.7: DISTRIBUTION OF COSTS IN EDUCATION *(GH¢ mn)*



Source: Estimations based of data provided by National Implementation Team.

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

National productivity is significantly affected by historical rates of child undernutrition. First, stunted people, on average, have had fewer years of schooling than non-stunted people[56] In non-manual activities, lengthier schooling is directly correlated with higher income.[57] Research shows that workers who were stunted in childhood and are engaged in manual activities tend to have less lean body mass[58]. and are more likely to be less productive in manual activities than those who were never affected by growth retardation.[59] Secondly, the population lost due to child mortality represents forgone economic growth, as they could have been healthy and productive members of the society.

The model utilizes historical nutritional information, in-country demographic projections, adjusted mortality rates, and data reported in the GDHS Survey from 2008 to estimate the proportion of the population whose labour productivity is affected by childhood nutrition.

As described in the health section of the report, the model estimated that 37 percent of the working-age population in Ghana were stunted as children. Research shows that adults who suffered from stunting as children are less productive than adults who were not stunted and are less able to contribute to the economy. This represents more than 5.49 million people whose potential productivity is affected by undernutrition.

The cost estimates for labour productivity were estimated by identifying differential income associated with lower schooling in non-manual activities, as well as the lower productivity associated with stunted people in manual work, such as agriculture. The opportunity cost of productivity due to mortality is based on the expected income of a healthy person in the workforce in 2012.

The distribution of the labour market is an important contextual element in determining the impact of undernutrition on national productivity. As illustrated in Figure 4.8, about 59 percent of the working-age population are engaged in manual activities. The tendency to work in manual activities seems to be reduced for age category 15-24 years, where at least 1 in 2 people are engaged in non-manual work. This could indicate a transition of the type of activity that the youthful (15-24 years) working population is able to access in the labour market, which is inclined towards more qualified labour.

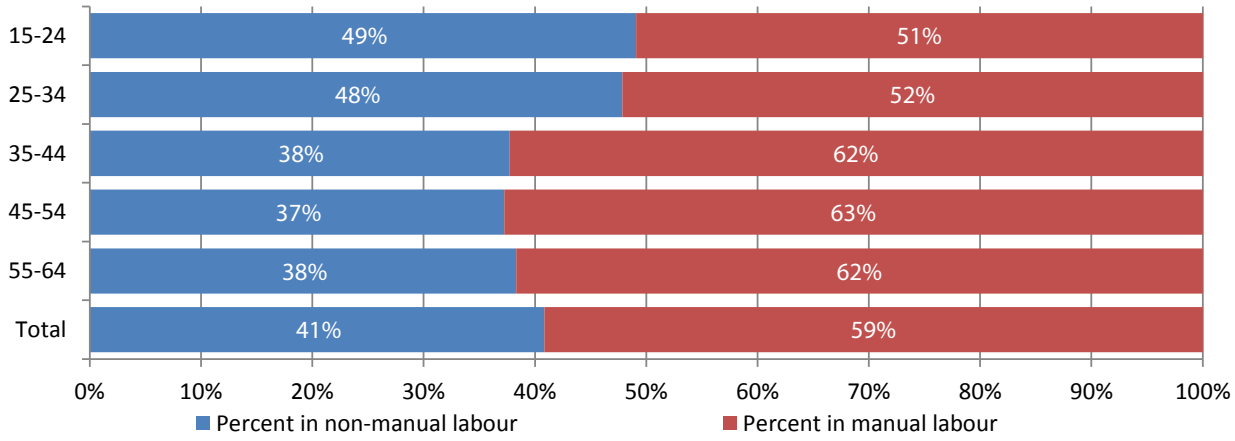
[56] Melissa C. Daniels and Linda S. Adair, "Growth in young Filipino children predicts schooling trajectories through high school," The Journal of Nutrition, March 22, 2004, pp. 1439-1446, accessed September 11, 2012, Jn.nutrition.org

[57] Based on expenditure/income data from Ghana Living Standards Survey (GLSS6), 2014/15, Accra: Ghana Statistical Service.

[58] C. Nascimento et al., "Stunted Children gain Less Lean Body Mass and More Fat Mass than Their Non-stunted Counterparts: A Prospective Study. Sao Paulo: Federal University of Sao Paulo, 2004.

[59] 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.

FIGURE 4.8: MANUAL AND NON-MANUAL LABOUR DISTRIBUTION, BY AGE, 2012



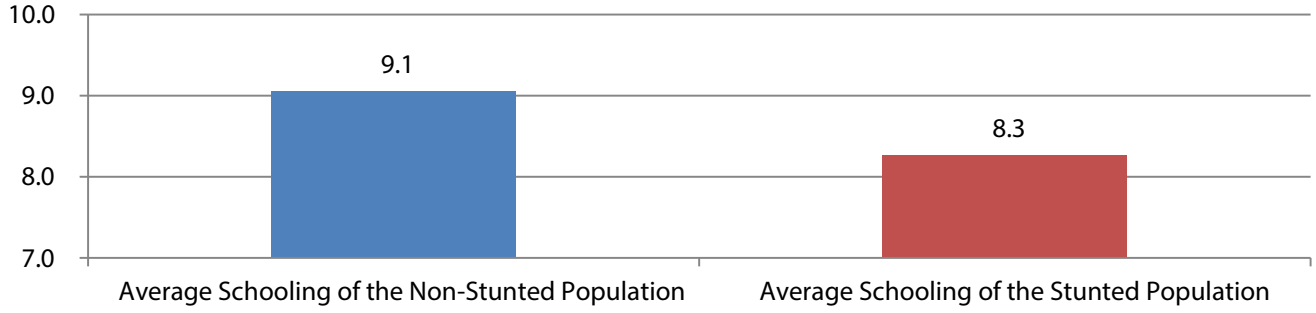
Source: Model estimations based on Ghana Statistical Service, Ghana Living Standards Survey (GLSS 6), 2012/13.

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

As described in the education section of this report, students who were undernourished as children complete, on average, fewer years of schooling than students who were adequately nourished as children.[60] This loss in educational years has a particular impact on people engaged in non-manual activities, in which a higher academic education represents a higher income.

Based on information from the NIT, it is estimated that the educational gap between the stunted and non-stunted population is 0.8 years (Figure 4.9). However, as evidenced in GLSS 6, it is important to note that over time, there has been an improvement in the average years of schooling among the working population. The cohort from 15-19 years shows an average level of school education of 7.3 years, while the cohort aged 25-29 shows an average of 9.0 years of education[61] respectively.

FIGURE 4.9: AVERAGE YEARS OF SCHOOLING FOR STUNTED AND NON-STUNTED POPULATION



Source: COHA model estimations based on data from GLSS6, Ghana Statistical Service, Ghana

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 presented in Table 4.5, the model estimates that 2,672,591 people engaged in non-manual activities suffered from childhood stunting. This represents 18.1 percent 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 GH¢628 million (US$349 million), equivalent to 0.86 percent of GDP in 2012.

[60] 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

[61] Based on data obtained from GLSS6: avearage education years estimated for the working age population across the different cohorts

TABLE 4.5 REDUCED INCOME IN NON-MANUAL ACTIVITIES DUE TO STUNTING, 2012

Age in 2012	Population working in non-manual sectors who were stunted as children	Income losses in non-manual labour	
		Millions of GHC	Millions of USD
15-24	947,948	168.5	93.82
25-34	795,554	234.9	130.85
35-44	445,832	112.1	62.46
45-54	295,190	70	39.01
55-64	188,066	42.5	23.68
Total	2,672,591	628	349.83
% GDP	**...**	**0.86%**	

Source: COHA model estimations based on data from GLSS6, Ghana Statsitical Service, Ghana

II. Losses in manual intensive activities

Earlier research shows that workers stunted as children and engaged in manual activities tend to have less lean body mass[62] and are more likely to be less productive in manual activities than those who were never affected by growth retardation.[63]

The model estimated that 8,230,455 people in Ghana are engaged in manual activities, of which 3,384,680 were stunted as children. This represented an annual loss in potential income of GH¢319 million (US$177.5 million), equivalent to 0.44 percent of GDP, due to lower productivity (Table 4.6).

TABLE 4.6: LOSSES IN POTENTIAL PRODUCTIVITY DUE TO MORTALITY ASSOCIATED WITH UNDERNUTRITION, 2012

Age in 2012	Population working in manual labour who were stunted as children	Income losses in manual labour	
		Millions of GH¢	Millions of US$
15-24	981,107	100	55.6
25-34	866,558	91	50.87
35-44	736,739	62	34.67
45-54	497,647	41	22.7
55-64	302,628	24	13.73
Total	**3,384,680**	**319**	**177.55**
% GDP	**...**	**0.44%**	

Source: COHA model estimations based on data from Ghana Statsitical Service, GLSS 6

62 C. Nascimento et al., Stunted Children gain Less Lean Body Mass and More Fat Mass than Their Non-stunted Counterparts: A Prospective Study. Sao Paulo: Federal University of Sao Paulo, 2004.

63 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.

III. Opportunity cost due to mortality

As indicated in the health section of this report, there is an increased risk of child mortality associated with undernutrition[64] The model estimated that 1,077,906 people of working age were absent from Ghana's workforce in 2012 due to child mortality associated with undernutrition. This represents a 7.3 percent reduction in the current workforce.

TABLEAU 4.7: LOSSES IN POTENTIAL PRODUCTIVITY DUE TO MORTALITY ASSOCIATED WITH UNDERNUTRITION, 2012

Age in 2012	Working Hours Lost due to Higher mortality of underweight children (In Millions of hours)	Income losses in non-manual labour	
		Millions of GH¢	Millions of US$
15-24	239,283	778.9	433.8
25-34	238,733	857	477.2
35-44	228,589	649.7	361.8
45-54	205,059	565.1	314
55-64	166,242	469.2	282.4
Total	1,077,906	3,320	1,848.7
% GDP	...	4.54%	

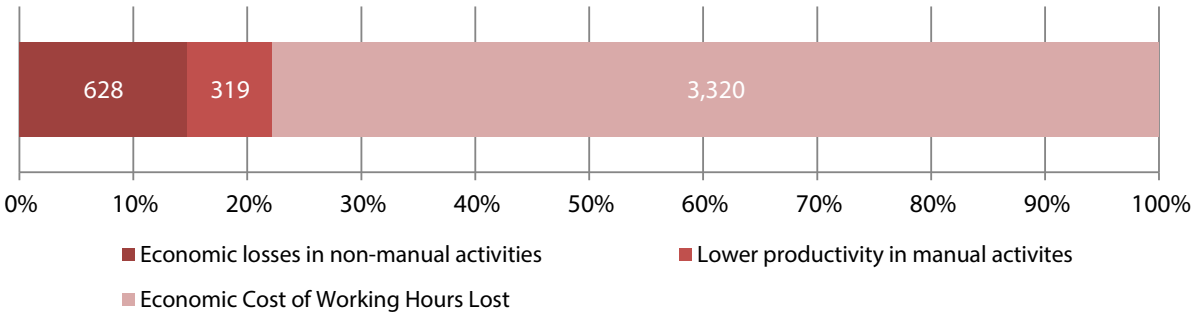
Source: COHA Model estimations based on adjusted mortality rates, demographic projections and data from GLSS 6

Considering the productivity of the population by age and sector of labour, the model estimated that in 2012, the economic losses (measured by working hours lost due to undernutrition-related child mortality) were GH¢3.32 billion, or 4.5 percent of GDP.

IV. Overall productivity losses

Total losses in productivity for 2012 are estimated at approximately GH¢4.267 billion (US$2.376 billion), equivalent to 5.8 percent of Ghana's GDP. As presented in Figure 4.10, the largest share of productivity loss is the result of mortality related to undernutrition, which represents 77.8 percent of total losses. The lost productivity in non-manual activities represents 14.7 percent of tesotal loss. The income differential in manual labour, due to the lower physical and cognitive capacity of people who suffered from growth retardation as children, represents 7.5 percent of the total losses.

GRAPHIQUE 4.10: DISTRIBUTION OF LOSSES IN PRODUCTIVITY *(GH¢ mn)*



Source: COHA Model estimations based on adjusted mortality rates, demographic projections and data from GLSS 6.

[64] 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

D. Summary of effects and costs

The methodology described in Section II is used to analyse the impact of child undernutrition at different stages of the life cycle, without overlaps. As a result, individual sectoral costs can be aggregated to establish a total social and economic cost of child undernutrition. For Ghana, the total losses associated with undernutrition are estimated at GH¢4.647 billion or US$2.588 billion for 2012. These losses are equivalent to 6.36 percent of GDP in 2012. The most substantial element in this cost is the loss in potential productivity as a result of undernutrition-related mortalities (Table 4.8).

TABLE 4.8: SUMMARY OF COSTS, 2012

	Episodes	Cost in millions of GH¢	Cost in millions of US$	Percentage of GDP
Heath Costs				
LBW and Underweight	1,092,424	329	183.5	
Increased Morbidity	236,256	28	15.8	
Total for Health	1,328,680	358	199	0.5%
Education Cost				
Increased Repetition - Primary	11,142	8	4.5	
Increased Repetition - Secondary	6,599	10	5.5	
Increased Repetition- Senior Secondary	1,979	5	2.9	
Total for Education	19,720	23	12.9	0.03%
Productivity Costs				
Lower Productivity - Non-Manual Activities	2,672,591	628	349.8	
Lower Productivity - Manual Activities	3,384,680	319	177.6	
Lower Productivity - Mortality	71,711	3,320	1,848.7	
Total for Productivity	6,128,983	4,267	2,376	5.8%
TOTAL COSTS	...	**4,647**	**2,588**	**6.4%**

WFP/Photolibrary

Section V

Analysis of Scenarios

Analysis of Scenarios

The previous chapter showed the social and economic costs that affected Ghana in 2012 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 affected by childhood undernutrition. Nevertheless, there is still room to prevent these costs in the future.

This section analyses the impact that a reduction in child undernutrition could have on Ghana's socio-economic situation. The results presented in this section project the additional costs to the health and education sectors as well as losses in productivity that Ghanaian 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 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 2012 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 children remains at the level achieved in 2012

For the baseline, the progress of reduction of the prevalence of undernutrition stops at the levels achieved in 2012. It also assumes that population growth maintains the pace reported in the year of analysis, thereby 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.

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

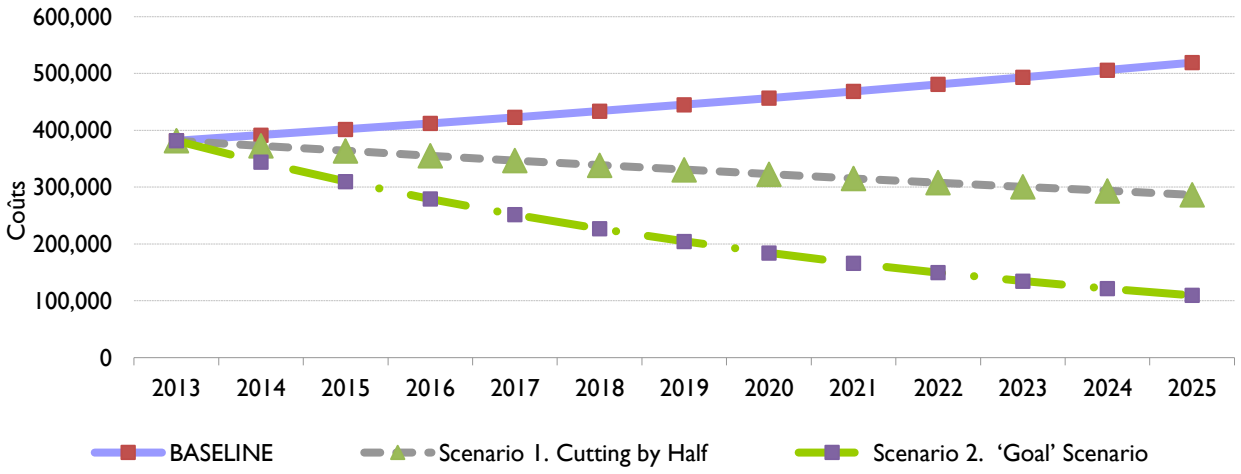
In this scenario, the prevalence of underweight and stunted children is reduced to half of values in 2012, the reference year. In the case of Ghana, this would mean a constant reduction of 0.87 percentage points annually in the stunting rate from 22.7 percent (estimate for 2012) to 13.4 percent in 2025. A strong effort has to be made to complete this scenario because one indicator of the effectiveness of ongoing interventions for the reduction of stunting is an average rate of reduction between 2005 and 2010 estimated at just 0.52 percent. However, even this is an improvement on the 0.3 percent average annual rate of reduction of stunting from 2000 to 2005.

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

In this scenario, the prevalence of stunted children is reduced to 10 percent and the prevalence of underweight children under the age of 5 to 5 percent. Currently, the global stunting rate is estimated at 26 percent, with Africa having the highest prevalence at 36 percent. This Goal Scenario would also require genuine action and would represent an important regional challenge to which countries of the region could collaborate on their response. The progress rate required to achieve this scenario is 0.98 percent annual reduction for a period of 13 years, from 2012 to 2025.

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

GRAPHIQUE 5.1: TRENDS OF ESTIMATED COSTS OF CHILD UNDERNUTRITION, 2012-2025 (*GH¢ mn*)



In the baseline, where the progress of reduction of child undernutrition would remain at 2012 levels, the total cost would increase by 47 percent, from GH¢1,736 million to GH¢2,544.7 million, during the period to 2025. Nevertheless, in Scenario 1, in which a reduction by half of current prevalence is achieved, the total cost would fall by 25 percent to GH¢1,295.6 million. In the case of the Goal Scenario on the other hand, there would be a 42 percent reduction in the estimated total costs, amounting to GH¢1,007.6 million.

TABLEAU 5.1: ESTIMATED TOTAL COSTS OF CHILD UNDERNUTRITION, BY SCENARIO, 2012 (GH¢ mn)[/a]

		Scenarios for the Year 2025		
	2013	Baseline. The Cost of Inaction	S1. Cutting by Half	S2. Goal Scenario
Heath Costs				
Increased Morbidity	440	673	336	251
Education Cost				
Increased Grade Repetition	4	6	2	1
Productivity Costs				
Lower Productivity in Non-Manual Activities	189	284	93	83
Lower Productivity in Manual Activities	54	81	20	17
Lower Productivity due to Mortality	1,048	1,501	844	652
Total Costs	**1,736**	**2,544.7**	**1,295.6**	**1,007.6**
Percentage Change from Baseline		47%	25%	42%

Source: Model estimations

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

As presented in Table 5.2, cutting undernutrition by half by 2025 would represent a reduction in costs of over GHc4,422.6 million, equivalent to US$2,462.7 million for the period from 2012 to 2025. Although the trend of savings would not be linear, even as they increased over time, a simple average of annual savings would amount to US$189.4 million per year. In the Goal Scenario, savings would increase to GH¢5,627.7 million, or US$3,133.8 million, at a simple average of US$241.1 million per year.

TABLE 5.2: ESTIMATED SAVINGS,BY SCENARIO, 2012 *(GH¢ millions)*

	Cutting Undernutrition by Half by 2025	Goal Scenario
Heath Costs		
Reduced Morbidity	1,161	1,516
Education Cost		
Reduced Grade Repetition	17	18
Productivity Costs		
Higher Productivity in Non-Manual Activities	708	759
Higher Productivity in Manual Activities	236	249
Increased Working Hours	2,292	3,086
Total Savings in GH¢	**4,422.6**	**5,627.7**
Total Savings in of US$	2,462.7	3,133.8
Average[1] Annual Savingsin GH¢	340.2	432.9
Average[1] Annual Savingsin US$	189.4	241.1

Source: COHA Model estimations
[1]Simple Average of total savings divided by the years considered in the period from 2012 to 2025

WFP/Photolibrary

VI Section

Conclusions and Recommendations

Conclusion and Recommendations

A. Conclusion

Like in many similar case studies across Africa, the Cost of Hunger in Ghana Study confirms the magnitude of the consequences that child malnutrition can have on health, education, productivity, but most importantly, it emphasizes the impact on the national economy and the need for a multi-sectorial policy approach in order to stem the consequences of stunting. If not addressed early enough, child malnutrition has the potential to impair a child's capacity to develop cognitive skills through mental retardation. More fundamentally, the study has shown that child malnutrition leads to repeated episodes of ailments, increased repetition in school grades and poor performance in labour markets in adult life.

Thus, the study highlights both challenges and opportunities for the country in reducing child undernutrition. It sheds some new light on the implications of adequate child nutrition for development, and thus, provides an opportunity to renew national commitments towards the elimination of child malnutrition in the country. Arguably, strategic investments in nutrition now will yield far higher benefits to Ghana than the imputed costs imposed on the economy for not preventing the scourge of child malnutrition in early life. For instance, the report found that the total losses in productivity for 2012 were approximately GHC 4.267 billion (US$ 2.376 billion), that is, equivalent to 5.8 percent of Ghana's GDP. These costs or losses to the economy could be averted through strategic interventions such as ensuring adequate nutrition for pregnant mothers and newly-born children.

Indeed, the report argues that the cost of inaction would be too colossal for the economy both now and in the future and hence makes a case for Ghana to leverage policy actions for a drastic reduction of stunting and malnutrition in the next ten to fifteen years. To achieve this, **it is recommended that aggressive targets are set in Ghana for the reduction of stunting that go beyond proportional reduction, to an absolute goal. Several countries, including Ghana, in the continent are planning on setting the goal to reduce stunting to 10% by the year 2025 which would represent a 56% decrease from 2012.**

In order to define actions and commitments towards the elimination of stunting in Ghana, national experts and stakeholders met in Accra in 2014 and suggested key actions that can contribute to this goal. In their recommendations five key areas were identified:

STRATEGIC PLANNING

It is recommended that appropriate strategies and policy actions should be devised that can effectively contribute to reduce the impact of child undernutrition in Ghana:

a. In this regard, nutrition should be positioned **as a key development priority of the government** as it is currently submerged within the Family Health Division of the Ghana Health Service. By allowing nutrition its own standalone place within the health sector, it will allow stakeholders to aggressively **solicit and enforce a strong government commitment on nutrition concerns and issues** and accelerate the implementation of the nutrition strategy.

b. This should be followed by **a statutory provision or benchmark that allows a certain percentage of the Assembly's common fund to be spent on nutrition related programmes.** This will include enhanced communication and coordination among all governmental and non-governmental strategic partners, as well as **allocating adequate funding to the relevant agencies.**

COORDINATION

In order to cut down on ad hoc arrangements and duplication of functions, there is need to put in place a robust coordination mechanism. This calls for the establishment of a multi-sectorial policy approach for a concerted fight against malnutrition, while improving the coordination of interventions. Some of the necessary steps to achieve a coordinated approach are:

a. Raising the profile of the nutrition agenda in the country, throughthe **establishment of a Nutrition Agency under the National Development Planning Commission**. Among many other functions, this agency should be charged with a **clear legal mandate to coordinate the activities of different sectors and position nutrition as a priority** in Ghana. This will facilitate and support a holistic and multi-sectorial approach to nutrition issues across Ghana.

b. Decentralising the multi-sectional approach by **establishing desk offices in key institutions and relevant Ministries, Departments, Agencies (MDAs) and Metropolitan, Municipal and District Assemblies (MMDAs)** to ensure proper coordination. As part of the national bureaucracy, this should be supported by adequate **allocation of funding for all relevant agencies** across the nutrition value chain.

c. As part of a wider communication strategy, authorities should enhance information flow and reporting by establishing a dedicated website/portal for nutrition interventions in Ghana. By creating a one-stop information shop for nutrition issues in Ghana, it is envisaged that key stakeholders can be continuously engaged on nutrition matters. The proposed one-stop-public-information-shop will subsequently help to **generate national policy debates to advocate for a specific allocation in the national budget for nutrition activities.**

d. In order to sustain the national momentum on nutrition, it is absolutely imperative to get increased government commitment to combat malnutrition as part of a broader strategy for improving people's welfare. This can be achieved in several ways that include the financial commitment of the Ghanaian government, **the coordination of activities of international organizations and initiatives, among them SUN, REACH and GAIN toward nutrition issues in Ghana.**

PROGRAMME IMPLEMENTATION

Scaling-up interventions under programme implementation for prevention and early treatment of child malnutrition will require the following:

a. Deliberate efforts to link educational programmes to nutrition programmes in order to generate a greater synergy and rationalisation of resources and information to supplement the current efforts in education and health care.

b. A robust advocacy strategy for increased current and future budget allocations for nutrition programmes. In this effort, it will be important to enlist the support of strategic partners and key national and international stakeholders. The focus should be on the quality of budgetary spending for optimal interventions and results.

c. On a continuing basis, efforts should be made to strengthen the monitoring and supervision of nutrition programmes at district level by providing adequate funding and technical expertise to those engaged in the exercise. This should be done by deploying **local resources, both human and financial,** and at the same time strengthening community-based programmes by scaling up nutrition-related education programmes that encourage behavioural change in the community with regard to food handling and general sanitary practices.

d. Health workers need support and resources **to engage with communities and strengthen awareness on good feeding practices**, especially in the first 1,000 days of a child's life.

MONITORING AND EVALUATION

In order to ensure sustainability of interventions, authorities should improve monitoring and evaluation (M&E) systems to be more nutrition sensitive and effective in assessing the short-, medium- and long-term impact of reducing child stunting in Ghana. The following practical ways should be adopted to help make the programme sustainable:

a. Ensure the systematic production of credible data and findings on nutrition issues and disseminate them widely to critical stakeholders, including communities, to generate national policy debates.

b. Ensure the multi-sectoral role of workers in collecting data for M&E officers is enhanced and strengthened at national and district levels. In this regard, the linkages between sectoral statistics (agriculture, health, water, education, etc.) should be developed and sustained. In the health sector, for instance, monitoring information on growth of under-5s and quality of antenatal care in communities should be made available and fed into overall health management information systems.

COMMUNICATION

Ultimately, the success of government and stakeholder interventions in addressing undernutrition in Ghana will be judged by how many people it is able to reach with appropriate and accurate information. It is imperative to increase awareness and

behavioural change in the population to adopt good practices of hygiene and nutrition in favour of children and pregnant women. The following are proposals towards an effective communication strategy for Ghana:

a. Strengthen awareness of good practices regarding feeding, nutrition and hygiene, while encouraging practices such as exclusive breastfeeding and food diversification from the perspective of nutrition, food hygiene and preservation of the environment.

b. Promote nutritional practices based on better use of local food. Raise awareness to convince the population on the nutritional quality of local foods and promote culinary practices that preserve these qualities.

c. Integrate nutrition programmes in education curricula to instil the importance of nutrition, food security and dietary diversification in education from early childhood.

WFP/Vera Boohene

VII Section
Annexes

Annexes

Annex 1. Glossary of Terms

1. Average number of days required 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 new-born 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).

Annexe II. Méthodes et hypothèses

Indicator	Data and Sources
Economic data	
Gross Domestic Product	Source: Ghana Statistical Service, Annual Report 2012. The figure was crosschecked with the World Bank database. The NIT also provided the latest information during the validation workshop.
US$ exchange rate	Based on the data obtained from Bank of Ghana. Official exchange rate refers to the exchange rate determined by national authorities or to the rate determined in the legally sanctioned exchange market. It is calculated as an annual average based on monthly averages (local).
Social expenditure	2012 Annual Progress Report, National Development Planning Commission
Health Expenditure	Ghana Health Sector Performance Report, Ministry of Health , 2012
Education Expenditure	Republic of Ghana Education Sector Performance Report, 2013, Ministry of Education, 2013
Average transport cost (two public transportation tickets in urban areas in local currency)	Ghana Living Standards Survey 6 (GLSS 6) Report, 2014. Average urban annual cash expenditure for transportation was considered as a proxy for average transport cost. Annual average cash expenditure for transport was GH¢874 (Table 10.7).
Minimum wage per hour	Ghana Living Standards Survey 6 (GLSS 6) Report, 2014. The minimum value of the average basic hourly earnings of currently employed working age population was considered as a proxy to estimate the minimum wage per hour. Based on this, GH¢0.58 hourly earnings for activities of extraterritorial organizations and bodies was taken, Table 5.12 lowest of the average hours cost was considered. GLSS6 Table 5.12, Page 56
Average wage per hour	Ghana Living Standards Survey 6 (GLSS 6) Report, 2014. The total average basic hourly earnings of currently employed working age population was considered as a proxy to estimate the average wage per hour. Based on this, total hourly earnings were set at GH¢1.17. Table 5.12, Page 56.

Indicator	Data and Sources
Consumer Price Index (CPI)	The Consumer price index (CPI) was used to deflate the 2013 household expenditure data to the base year 2012. For this purpose, CPI in December of each year, 2013 and 2012, was considered. Based on this 89.55 percent deflation, based on the average consumer price for 2013 and 2012, was estimated.
Average income per years of schooling	Based on the Ghana Living Standards Survey 6 (GLSS 6), average expenditure data were considered as a proxy for income. 2013 Household Expenditure is adjusted/deflated to 2012. Ghana Statistical Service, 2012/2013.
Distribution des activités manuelles et non-manuelles, par groupe d'âge	Based on International Standard Industrial Classification (ISIC) code list, 2010 and expenditure data from the Ghana Living Standards Survey 6 (GLSS 6), Ghana Statistical Service. Manual Activities include: 11.00 '11 Agriculture': 12.00 '12 Livestock'; 13.00 '13 Forestry'; 14.00 '14 Fishing & Hunting'; 21.00 '21 Mining'; 22.00 '22 Quarrying'; 31.00 '31 Food Manufacture'; 32.00 '32 Textile Manufacture" 33.00 '33 Wood Products Man.'; 34.00 '34 Paper Products Man.'; 35.00 '35 Chemical Industries'; 36.00 '36 Non-metallic Products. Man.'; 37.00 '37 Metal Manufacture'; 38.00 '38 Metal Products Man.'; 41.00 '41 Gas, Water & Electricity'; 51.00 '51 Construction Buildings"; 52.00 '52 Construction Roads'; 53.00 '53 Rural Reconstruction'. Non-Manual activities include 61.00 '61 Wholesale Trade' 62.00 '62 Retail Trade'; 63.00 '63 Other Trade'; 64.00 '64 Hotel & restaurants'; 65.00 '65 Import & Export'; 71.00 '71 Transport'; 72.00 '72 Warehousing'; 73.00 '73 Communications'; 81.00 '81 Banking'; 82.00 '82 Insurance'; 83.00 '83 Real Estate'; 84.00 '84 Business Services'; 91.00 '91 Government, Admin & Social Services'; 92.00 '92 Recreation & Tourism'. Kalkidan Asseffa K. (2014)
Revenu annuel moyen relatif à l'emploi productif pour des activités manuelles, par groupe d'âge	Based on expenditure data from Ghana Living Standards Survey 6 (GLSS 6). Average expenditure data were considered as a proxy for income for manual work. 2013 household expenditure is adjusted/deflated to 2012. Ghana Statistical Service, 2012/2013, Kalkidan Asseffa K. (2014)
Annual average income related to productive work, manual intensive activities by age	Based on expenditure data from Ghana Living Standards Survey 6 (GLSS 6). Average expenditure data were considered as a proxy for income for non-manual work. 2013 Household expenditure is adjusted/deflated to 2012.Ghana Statistical Service, 2012/2013, Kalkidan Asseffa K. (2014)
Annual average income related to productive work, NON manual intensive activities by highest educational level attained and age	Based on Expenditure data from "Ghana Living Standard Survey 6 (GLSS6)". Average Expenditure data was considered as a proxy for Income for Non Manual work. 2013 Household Expenditure is adjusted/deflated to 2012.Ghana Statistical Service, 2012/2013, Kalkidan Asseffa K. (2014)
Average working hours per week	Based on data from Ghana Living Standards Survey 6 (GLSS 6). It is estimated based on the average official government working hour per day (8 hours) and multiplied by the number of working days per week.
Annual worked hours per age group	Estimated based on the average official government working hour per day (8 hours) and multiplied by the number of working days per week (5 days) and total number of weeks (52 weeks) per year.
Demographic Data	
0 Years of Age - Total Population Projected from 1948-2012	United Nations Statistics Division – Demographic and Social Statistics – Accessed November 2013. Processed with the Support of the African Centre for Statistics at ECA. Tesfaye G. (2013)
0 - 4 years total population Projected from 1948-2012	
Population in 2012 by age	

Indicator	Data and Sources
Mortality rate for children under 5 and Survival rate, projected from 1950 to 2050	Calculated from Abridged Life Tables provided by the UN Statistics Division – Demographic and Social Statistics. Aseffa S. (2013). For detailed calculation process please review Rodrigo Martínez and Andrés Fernández, Operational manual for the use of the model for analysing the social and economic impact of child undernutrition in Latin America, Naciones Unidas, CEPAL, Social Development Division, Santiago de Chile, 2008, pages 18-26.
Working age population (WAP) by educational level	Calculated from the Ghana Living Standards Survey 6 (GLSS 6). Data accessed from Ghana Statistical Service, 2013/2014, The total working age population was estimated based on the working age and educational level values obtained from GLSS 6. Grade level 12 includes all grade levels equal and above grade 12. Kalkidan Asseffa K. (2014)
Health Data	
Primary health data were collected from representative hospitals (Achimota and KBTH) and health centres (Amanfro and Kokrobite) to estimate the health protocol and cost data. Those hospitals and health centres were selected based on their national level representativeness for the number patients and services provided for both OPD and IPD medical cases. Professionals like pediatricians, nurses, pharmacists, and other non-health professionals from management, finance and planning units of each hospital and health centre were consulted to estimate the average cost Therefore all the primary data are based on interviews with key informants and experts from the sample hospitals and health centres. Additional health data were also obtained from large insurance companies.	
Underweight prevalence of children under 5 years old	Calculated from Multiple Indicator Clustor Survey (MICS, 2011) and Demographic and Health Survey 2008. Ghana Statistical Service and Ghana Health Service. Historical data calculated based on "WHO Global Database on Child Growth and Malnutrition" WHO. Accessed May 12, 2014. http://www.who.int/nutgrowthdb/en//
Stunting prevalence of children under 5 years old	
Stunting and Underweight mode prevalence	Calculated based on the highest prevalence register in the age groups based on historical data obtained from WHO Global Database on Child Growth and Malnutrition, WHO. Accessed May 12, 2014 http://www.who.int/nutgrowthdb/en//. The data were cross-checked with Ghana Demographic and Health Survey 2008 and MICS 2011.
Number of annual disease episodes per child for (Anaemia, ADS, ARI, Malaria, Underweight) by Age group	Estimated through consultation with Achimota Hospital health specialists and experts. And the following values were estimated. The incidence rate of Anaemia for 28days-11month is 1 episodes; 12-23 months is 1 episodes; 24-59 months is 1 episode per child. ADS: 28days-11months is 4 episodes; 12-23 months is 3 episodes; 24-59 months is 3 episode per child. ARI: 28days-11months is 3 episodes; 12-23 months is 4 episodes; 24-59 months is 4 episodes per child. Underweight: 28days-11months is 3 episodes; 12-23 months is 2 episodes; 24-59 months is 2 episodes per child. Malaria: 28days-11months is 3 episodes; 12-23 months is 3 episodes; 24-59 months is 3 episodes per child per year.
Average number of primary care visits for each pathology (Anaemia, ADS, ARI, Underweight, Malaria) by Age group	Estimated through consultation with Achimota hospital health specialists and experts. And the following values were estimated. The average no. of primary care visits for Anaemia 28days-11months is 2 episodes, 12-23 months is 1episodes, 24-59 months is 1episodes per child per year. ADS: 28days-11months is 4 episodes; 12-23 months is 2 episodes; 24-59 months is 2 episode per child per year. ARI: 28days-11months is 3 episodes; 12-23 months is 3 episodes; 24-59 months is 3 episodes per child per year. Underweight: 28days-11months 1 is 5 episodes; 12-23 months is 4 episodes; 24-59 months is 4 episodes per child per year. Malaria: 28days-11months is 3 episodes; 12-23 months is 2 episodes; 24-59 months is 3 episodes per child per year.

Indicator	Data and Sources
Proportion of events of pathology (Anaemia, ADS, ARI, Malaria, Underweight) by Age group requiring hospitalization	Estimated through consultation with Achimota hospital health specialists and experts. And the following values were estimated. Anaemia: (severe anaemia cases as proxy was considered) for 28-11m = 9.1%; for 12-23 months = 13.3%; for24-59 months=18.7%, ADS: for28-11m=36.3%; for 12-23 months= 27%; for 24-59 months=18.7%; ARI: for28-11m= 18.1%; for 12-23 months= 27%; for 24-59 months=25%. Underweight: for 28-11m= 9.1%; for 12-23 months= 20%; for 24-59 months=12.5%, Malaria: for28-11m= 27.2%; for 12-23 months= 20%; for 24-59 months=25%
Average number of days of hospital treatment for each event (Anaemia, ADS, ARI, Malaria, Underweight) by Age group	Estimated through consultation with Achimota hospital health specialists and experts. And the following values (in days of hospitalization) were estimated. Anaemia: 3 days (same for all sub-cohorts). ADS: 3 days (same for all sub-cohorts). ARI: 3 days (same for all sub-cohorts); Underweight: 5 days (same for all sub-cohorts). Malaria: 3 days (same for all sub-cohorts).
Average waiting time spent at primary care attention by pathology	It was estimated through consultation with Achimota hospital health specialists and experts. And the following values (in hours) were estimated. Anaemia: 3 hours; ADS: 6 hours; ARI: 4 hours; Underweight: for28-11m = 3 hours; for 12-23 months = 4 hours; for 24-59 months= 4 hours; Malaria: 4 hours.
Daily hours lost due to hospitalization by pathology	Estimated at an average of 8 daily hours lost.
Average unit cost for attention in primary care by age group and pathology	The average unit cost for attention in primary care was estimated based on hospital/health facility records and interviews with health specialists and experts. The unit cost for Out-Patient attention (OPD) takes into account the Overhead and Direct costs associated with provision of medical consultation. Overhead costs include: annual expenditure of water, electric power, fuel as well as maintenance of the primary care facility. These overhead costs were divided by the annual number of outpatients. Direct costs include: number and qualification (paediatricians, general practitioners, nurses, etc.) of medical staff and the time (in minutes) each of them dedicate to the patient. Based on their hourly salary, the unit cost for attention is subsequently calculated. For a full overview of the average unit cost for attention per pathology, see the Health Protocol and Costing Guidelines, UNECA, 2014.
Average cost of medical inputs for event in primary care by age group and pathology	The average cost of medical inputs for an event in primary care was estimated based on hospital/health facility records and interviews with health specialists, experts from drug stores and central pharmacies. The costing of these inputs was done based on a full list of the different types of medicines for treatment of each pathology. For a full overview of all the medical inputs and cost per pathology, see the Health Protocol and Costing Guidelines.
Average unit cost for attention in hospital by age group and pathology	Average unit cost for attention in hospital was estimated based on hospital records and interviews with health specialists and experts. The unit cost for In-Patient attention (IPD) takes into account the Overhead and Direct Costs associated with provision of medical consultation and hospital bed cost. Overhead costs considered: the annual expenditure of water, electric power, fuel and food as well as the maintenance of the hospital. These overhead costs were divided by the annual number of inpatients. Direct costs considered: the number and qualification (pediatricians, general practitioners, nurses, etc.) of medical staff and the time (in minutes) each of them dedicates to the patient. Based on their hourly salary, the unit cost of attention is subsequently calculated. In addition, the average daily cost of a hospital bed is also included. For a full overview of the average unit cost for attention per pathology, refer to the Health Protocol and Costing Guidelines.

Indicator	Data and Sources
Average cost of medical inputs for event in hospital by age group and pathology	The average cost of medical inputs for an event in hospital was estimated based on hospital records and interviews with health specialists, experts from drug stores and central pharmacies. Medical inputs considered only medicines for treatment. The costing of these inputs was done based on the Central Drug Store or Central Pharmacy's drug costing records. For a full overview of all medical inputs and cost per pathology, consult the Health Protocol and Costing Guidelines.
Average private cost of medical inputs for event by age group and pathology	In Ghana, all health services from public health facilities are covered by national/ district health insurance schemes. Therefore, this cost was estimated based on the cost covered by the national insurance scheme for individuals.
% of Cases who attend Health Services	For low birth weight, the percentage of all births with reported low birth weight was considered as a proxy for the percentage of cases that attend health services (42.8 percent; page 164, Table 10.1). Calculated from Ghana Demographic and Health Survey Report 2008. For anaemia, diarrhoeal, ARI and malaria cases, it is estimated in-house based on the percentage of people who sought medical services from health facilities, as per GDHS 2008 data (anaemia = 32 percent, diarrhoeal = 57 percent, ARI = 50 percent and malaria = 50 percent)
Average travel time for ambulatory care.	Established at 2 hours for all cases and pathologies. It was an average estimated time to reach a referral hospital from rural places, according to key informant interviews.
Percentage of low birth weight children	8.48 percent was considered for low birth weight as an estimate based on the number of births of low birth weight babies to total live births – %LBW = number of births of low birth weight/total live births = (49,655/585,443)*100 = 8.48 percent. Source District Health Information Management System (DHIMS).
Proportion of events of LBW requiring/access hospitalization	100 percent of cases of LBW require hospitalization (estimated by health specialists and experts through in-depth interview).
Average number of days of hospital treatment for LBW	A minimum of 14 days is recommended for LBW. Estimated by health specialists and experts through in-depth interview.
Morbidity differential probability for anaemia among healthy versus underweight children by age groups.	Calculated in-house at 7.5 percent for children under 5, from GDHS data (GDHS, 2008) utilizing the prevalence of anaemia (moderate or severe) among underweight children and the prevalence among non-underweight children differentiated by age group. Kalkidan Asseffa K. (2015)
Morbidity differential probability for ADS among healthy versus underweight children by age groups.	Calculated in-house at 8.2 percent for children under 5, from Demographic and Health Survey data (DHS, 2008) utilizing the prevalence of acute diarrhoeal syndrome – ADS (reported diarrhoea in the last 2 weeks) among underweight children and the prevalence among non-underweight children differentiated by age group. Kalkidan Asseffa K. (Jan. 2015)
Morbidity differential probability for ARI among healthy versus underweight children by age groups.	Calculated in-house at 2.6 percent for children under 5, from Demographic and Health Survey data (DHS, 2008) utilizing the prevalence of acute respiratory infection - ARI (data on children who were ill with a cough accompanied by rapid breathing) among underweight children and the prevalence among non-underweight children differentiated by age group, Kalkidan Asseffa K. (Jan. 2015)
Morbidity differential probability for Fever among healthy versus underweight children by age groups.	Calculated in-house at 2.9 percent for children under 5, from Demographic and Health Survey data (DHS, 2008) utilizing the prevalence of fever/malaria (data on children who reported fever in last 2 weeks) among underweight children and the prevalence among non-underweight children differentiated by age groups. Kalkidan Asseffa K. (Jan 2015)

Indicator	Data and Sources
Hazard Ratio of child mortality associated with underweight	Estimated at 2.86, based on calculations by Acosta C., Martinez R. (2013) from 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)
Hazard ratio for child mortality associated with stunting	Estimated at 2.33, based on calculations by Acosta C., Martinez R. (2013) from 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
Education Data	
Enrolment by grade in Primary	Ghana. Ministry of Education. 2012/13 Education Management Information System. Basic National Level Enrolment Data. Data were obtained from Ministry of Education, 2012/13 Page 104, Enrolment Data,
Enrolment by grade in Secondary	Ghana. Ministry of Education. 2012/13 Education Management Information System. Basic National Level Enrolment Data. Data were obtained from Ministry of Education, 2012/13 Page 104, Enrolment Data,
Number of passes by grade	Calculated by grade by the Ministry of Education with data for 2012. The promotion rates/completion rates for primary, junior high school and senior high school were taken from the Ministry of Education's Statistics, Research and Information Management (SRIM) section. The values for Primary = 93.7%, JHS = 66.8% and SHS = 34.4 % were considered as the completion rate
Number of population repeating grades by grade	Calculated by grade by the Ministry of Education with data for 2012. The repetition rates for primary, JHS and SHS levels were taken from EMIS 2012 (Page 28, Table 4.3 and Page 69, Table 22) and the rates were applied to the same year enrolment data by grade level.
Annual Private/Public cost per student / year by educational level	Estimated based on the data from GLSS 6 and Ministry of Education, Education Sector Performance Report (ESPR 2013 and 2015). Private cost from GLSS 6 and public cost from Education Sector Performance Report (2013 and 2015). Primary education – public cost: GH¢400; cost to families: GH¢321.64. JHS – public cost GH¢818; JHS – cost to families: GH¢674; SHS – public cost: GH¢1,227; cost to families: GH¢1,393.29.
Relative Risk associated of grade repetition associated with stunting	Estimated at 1.35, based on calculations from Cebu Longitudinal Health and Nutrition Survey, with support from Melissa C. Daniels
Relative Risk associated of dropping out associated with stunting	Estimated at 1.61, based on calculations from Cebu Longitudinal Health and Nutrition Survey, with support from Melissa C. Daniels

Annexe III. Consulted Resourcess

"About." Scaling Up Nutrition. Accessed March 13, 2013. http://scalingupnutrition.org/about

African Regional Nutrition Strategy: 2005-2015. Report. African Union, 2005. http://www.who.int/nutrition/topics/African_Nutritional_strategy.pdf

African Union. Directorate of Information and Communication."CAMH5 Moves in to Gear with Meeting on Food and Nutrition Development. News release, April 14, 2011. African Union. http://www.au.int/en/sites/default/files/task%20force%20on%20food%20and%20nutrition%20development.pdf.

Almond, Douglas. Long-term Effects of the 1959-1961 *China Famine: Mainland China and Hong Kong*. Working Paper 13384, (National Bureau of Economic Research, 2007), Http://www.nber.org/papers/w13384.pdf?new_window=1.

"Birth Rate, Crude (per 1,000 People)." Data. Accessed March 14, 2013. http://data.worldbank.org/indicator/SP.DYN.CBRT.IN.

Black, Robert E., Lindsay H. Allen, Zulfiqar A. Bhutta, Laura E. Caulfield, Mercedes De Onis, Majid Ezzati, Colin Mathers, and Juan Rivera. "Maternal and Child Under nutrition: Global and Regional Exposures and Health Consequences." The Lancet 371, no. 9608 (2008): 243-60. doi:10.1016/S0140-6736(07)61690-0.

Black, Robert E., Lindsay H. Allen, Zulfiqar A. Bhutta, Laura E. Caulfield, Mercedes De Onis, Majid Ezzati, Colin Mathers, and Juan Rivera. "Maternal and Child Under-nutrition: Global and Regional Exposures and Health Consequences." The Lancet 371, no. 9608 (2008): 243-60. doi:10.1016/S0140-6736(07)61690-0.

Bryce, J., C. Boschipinto, K. Shibuya, and R. Black. "WHO Estimates of the Causes of Death in Children." The Lancet 365, no. 9465 (2005): 1147-152. Accessed March 13, 2013. doi:10.1016/S0140-6736(05)71877-8. \

"Cebu Longitudinal Health and Nutrition Survey." UNC Carolina Population Center. Accessed March 13, 2013. http://www.cpc.unc.edu/projects/cebu/.

Coly, Aminata N., Jacqueline Milet, and Aldiouma Diallo. "Preschool Stunting, Adolescent Migration, Catch-up Growth, and Adult Height in Young Senegalese Men and Women of Rural Origin." Journal of Nutrition, June 10, 2008, 2412-420. Http://jn.nutrition.org.

FAO (2012), *Crop Prospects and Food Situation*. http://www.fao.org

C. Nascimento et al., Stunted Children gain Less Lean Body Mass and More Fat Mass than Their Non-stunted Counterparts: A Prospective Study., report (Sao Paulo: Federal University of Sao Paulo, 2004).

Daniels, Melissa C., and Linda S. Adair. "Growth in Young Filipino Children Predicts Schooling Trajectories through High School." *The Journal of Nutrition*, March 22, 2004, 1439-446. Accessed September 11, 2012. Jn.nutrition.org.

Data provided to COHA from Education Management Information Systems Unit (EMIS), 2009, http://www.gov.sz

Data provided by the UN Population Division, http://www.un.org/esa/population/unpop.htm

"Draft Resolution 898(XLV) The Cost of Hunger in Africa: Social and Economic Impacts of Child Under-nutrition," Report of the Committee of Experts of the Fifth Joint Annual Meetings of the AU Conference of Ministers Of Economy and Finance and ECA Conference of African Ministers of Finance, Planning And Economic Development. Addis Ababa: African Union, 2012.

Grebmer, Klaus Von. "Financial Crisis Adding to the Vulnerabilities of the Hungry." In 2009 Global Hunger *Index: The Challenge of Hunger, Focus on Financial Crisis and Gender Inequality. Bonn: Welthungerhilfe, 2009*.

H. Alderman, "Long Term Consequences of Early Childhood Malnutrition," Oxford Economic Papers 58, no. 3 (May 03, 2006), doi: 10.1093/oep /gpl008

Haddad, Lawrence J., 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): 45-68. doi:10.1111/j.1468-0084.1991.mp53001004.x.

Human Development Report 2011. Report. New York: UNDP, 2011. http://hdr.undp.org/en/reports/global/hdr2011/.

"Hunger Statistics." FAO: FAO Hunger Portal. Accessed March 14, 2013. http://www.fao.org/hunger/en/.

Institut national de la statistique, des études économiques et démographiques (INSEED), Tchad : « Enquête sur la consommation et le secteur informel au Tchad (2014) » ; *« Enquête par grappes à indicateur multiples, Tchad (2010) » ; « Recensement Général de la Population et de l'Habitat (2009) » ; « Enquête Démographique et de Santé (2004) ».*

K.G. Dewey and K. Begum, *Long-term consequences of stunting in early life*. Maternal and Child Nutrition (2011), 7 (Suppl. 3), pp. 5–18

Martínez, Rodrigo, and Andrés Fernández. Model for Analyzing the Social and Economic Impact of Child Under nutrition in Latin America. Santiago De Chile: Naciones Unidas, CEPAL, Social Development Division, 2007.

Ministère de l'éducation nationale et l'enseignement professionnel, Tchad *« Annuaire statistique de l'éducation nationale (2012-2013) » ; « Rapport d'Etat sur le Système Educatif National (2013) » ; « Comptes administratifs (2013) ».*

"Mortality Rate, Under-5 (per 1,000 Live Births)." Data. Accessed March 14, 2013. http://data.worldbank.org/indicator/SH.DYN.MORT.

Ndaruhutse, Susy, Laura Brannelly, Michael Latham, and Jonathan Penson. *Grade Repetition in Primary Schools in Sub-Saharan Africa: An Evidence Base for Change*. Report. CFBT, 2008. http://www.cfbt.com.

"Nobel Laureate Panel Findings." Nobel Laureate Panel Findings. Accessed March 13, 2013. http://www.copenhagenconsensus.com/Default.aspx?ID=1637.

"Public Spending on Education, Total (% of GDP)." Data. Accessed March 13, 2013. http://data.worldbank.org/indicator/SE.XPD.TOTL.GD.ZS.

Ramachandran P. & Gopalan H., *"Under nutrition& risk of infections in preschool children"*. Indian J Med Res 130, November 2009, pp 579-583

Report of the Committee of Experts of the Fifth Joint Annual Meetings of the AU Conference of Ministers Of Economy and Finance and ECA Conference of African Ministers of Finance, Planning And Economic Development. Addis Ababa: African Union, 2012.

Report on the Global AIDS Epidemic. Report. UNAIDS, 2012. http://www.unaids.org/.

Salomon, J., P. De Truchis, and J.C. Mechoir. "Nutrition and HIV Infection." British Journal of Nutrition 87, no.Suppl. 1 (2002). Cambridge University Press.

The State of Food Insecurity in the World. Report. Rome: FAO, 2012. http://www.fao.org/docrep/016/i3027e/i3027e00.htm.

"UNESCO Institute for Statistics." UNESCO Institute for Statistics. Accessed March 13, 2013. http://stats.uis.unesco.org/unesco/tableviewer/document.aspx?ReportId=143.

"United Nations Statistics Division - Classifications Registry." United Nations Statistics Division - Classifications

Registry. 2008. http://unstats.un.org/unsd/cr/registry/regcst.asp?Cl=27.

"Unstats, Millennium Indicators." RSS Main. July 2, 2012. Accessed March 13, 2013. http://mdgs.un.org/unsd/mdg/Data.aspx.

"USAID Commodities Reference Guide." USAID Commodities Reference Guide - Annex I: Definitions. January 2006. http://transition.usaid.gov/our_work/humanitarian_assistance/ffp/crg/annex-1.htm.

VAM Standard Analytical Framework. World Food Programme, 2002.

Wardlaw,, Tessa, Holly Newby, David Brown, Xiaodong Cai, Mercedes De Onis, and Elaine Borghi. *Levels & Trends in Child Malnutrition: UNICEF-WHO-The World Bank Joint Child Malnutrition Estimates*. Report. 2012. http://www.who.int/nutgrowthdb/jme_unicef_who_wb.pdf.

"WHO Global Database on Child Growth and Malnutrition." WHO. Accessed March 13, 2013. http://www.who.int/nutgrowthdb/en//.

World Bank Database

"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.

"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. http://www.who.int/nutgrowthdb/jme_unicef_who_wb.pdf.

WHO. Management of severe malnutrition: a manual for physicians and other senior health workers. ISBN 92 4 154511 9 (NLM Classification: WD 101). 1999.

WHO. Integrated Management of Pregnancy and Childbirth. ISBN 92 4 159084 X. 2009

"WHO Global Database on Child Growth and Malnutrition." WHO. Accessed March 13, 2013. http://www.who.int/nutgrowthdb/en//.

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

"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.

"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.

WFP/Nyani Quarmyne

THE NEW PARTNERSHIP FOR AFRICA'S DEVELOPMENT
NEPAD
A PROGRAMME OF THE AFRICAN UNION

WFP
World Food Programme
wfp.org

United Nations
Economic Commission for Africa