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Stunting Reduction in Sub-Saharan Africa

WORLD BANK GROUP

Contents

Acknowledgments

Task Team Leaders (TTLs) for the analytics are Patrick Eozenou and Meera Shekar. Patrick Eozenou led the work on Chapter 1 and Meera Shekar led Chapters 2 through 7. The team consisted of Jonathan Kweku Akuoku, Julia Dayton Eberwein, Jakub Kakietek, Michelle Mehta, Parendi Mehta, Linda Schultz, and Dylan Walters.

For Chapter 1, Patrick Eozenou conceived the study, prepared the first draft of the report, and conducted the econometric analysis; Parendi Mehta constructed the aggregate dataset, prepared descriptive statistics tables, reviewed the empirical literature, and provided inputs to the draft report; and Jakub Kakietek contributed to background section and provided key inputs to the report.

For Chapters 2 through 7, Meera Shekar defined the overall parameters for the analyses and the selection of the five high-burden countries, and she provided overall quality-control and guidance. Jakub Kakietek undertook the regional costing and impact analysis for stunting and wasting and wrote parts of that section with Michelle Mehta and Julia Dayton Eberwein. Jonathan Kweku Akuoku prepared the financing and costing analysis for stunting and wasting for the five country studies and drafted most of those sections. Dylan Walters prepared the costing and impact analysis for anemia and breastfeeding for the regional analyses and the five country studies. The background sections for the country studies were drafted by Linda Schultz. Julia Dayton Eberwein and Michelle Mehta provided technical guidance and overall management of the country studies and the regional brief.

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Executive Summary

Reducing all forms of malnutrition, including stunting, is central to the World Bank Group's twin goals of ending extreme poverty and promoting shared prosperity, as well as building resilience and preventing instability. Maternal and child undernutrition is estimated to be responsible for about 45 percent of child mortality and 11 percent of the global disease burden. Conversely, reductions in stunting are estimated to potentially increase overall economic productivity, as measured by GDP per capita, by 4 to 11 percent in Africa and Asia – making investments in early nutrition one of the most cost-effective development actions to yield permanent and inalienable benefits.

Since 2000, progress in stunting reduction has been slower in Africa than in other regions. While both Asia and Latin America and Caribbean have managed to reduce stunting rates by over one third, Africa saw a reduction of only one sixth during the same period. In 2016, over 40 percent of the 159 million stunted children globally were in Africa (UNICEF, WHO, and World Bank, 2016).

Accelerating the reduction of stunting in Africa will be key to maximizing the return on investments in early childhood development, in education, and more broadly in policies aimed at fostering and enhancing human capital accumulation and job creation. Investing in the Early Years now in Africa is even more critical to the extent that the region is entering a demographic transition process with an expected increase in the working age population share from 54% in 2010 to a peak of 64% in 2090. Scaling up investments today in effective interventions and policies to reduce stunting will be a necessary condition to harness the potential benefits of the demographic dividend in the region.

This report consists of seven chapters. The first chapter focuses on the income elasticity of stunting reduction in Sub-Saharan Africa. Chapters 2 through 7 focus on the potential financing needs and impacts of investing in scaling up stunting reduction interventions in the Africa region as a whole, and in five of the high-burden countries in Africa (Benin, Côte d'Ivoire, Ethiopia, Niger, and Rwanda). While the first chapter offers a broad assessment of the empirical relationship between income and stunting reduction at the aggregate level across countries, the subsequent chapters focus on country specific policy recommendations designed to accelerate progress in stunting reduction.

The Income Elasticity of Stunting Reduction in Sub-Saharan Africa

The first chapter of the report estimates the income elasticity of stunting reduction and compares elasticities in Sub-Saharan Africa (SSA) to countries in other regions. Using cross-country panel data for 151 countries the income elasticity of stunting reduction is estimated to be, on average, close to −0.44. The statistical difference in income elasticity between SSA countries and non SSA countries is formally tested. Although a 10 percent increase in income is associated with a 5.5 percent reduction in the stunting rate in non-SSA countries, the return of stunting reduction to income is more than 2.5 times lower in SSA countries (−0.2). These results are robust to endogeneity bias, to unobserved country-specific heterogeneity, and to alternative modeling assumptions. Differences in access to water and sanitation account for about half of the gap in the magnitude of income elasticities between non-SSA and SSA countries. Differences in the degree of control of corruption and of government effectiveness between SSA and non-SSA countries account for a sizeable part of the difference in the estimated income elasticity. Projecting these results forward to 2030 implies that the number of stunted children is likely to increase in Sub-Saharan Africa—from about 52 million in 2015 to approximately 60 million in 2030—while the global target endorsed at the 65th World Health Assembly called for a 40 percent reduction in the number of stunted children between 2010 and 2025. These results, together with the existing body of empirical evidence on intervention effectiveness, suggest that scaling up a set of high-impact nutrition-specific interventions is needed to accelerate the pace of reduction and to achieve progress against the United Nations' 2030 Sustainable Development Goal targets in the region.

Investing in Nutrition in the Africa Region

The report then estimates the expected impacts and financing needs for scaling up a set of high-impact nutrition-specific interventions for the Africa region as a whole (Chapter 2) and in five countries (Benin, Côte d'Ivoire, Ethiopia, Niger, and Rwanda) in Chapters 3 to 7.

In 2012, the World Health Assembly endorsed six global targets for improving nutrition in an effort to boost investments in cost-effective interventions, spearhead better implementation practices and catalyze progress toward decreasing malnutrition. Scaling up a package of high-impact nutrition-specific interventions in Africa to address four of the six global nutrition targets of stunting, anemia, breastfeeding, and wasting would require, on average, an additional $2.7 billion per year over the next 10 years and would provide substantial health and economic benefits: It would prevent nearly 17 million cases of child stunting and 2 million child deaths. The economic benefits generated over the productive lives of beneficiaries would be enormous: the region would gain $67 billion from investments in preventing stunting, $16 billion from preventing anemia, $20 billion from increased breastfeeding, and $13 billion from treating severe wasting (acute malnutrition)[1] . Returns on every dollar invested in this set of interventions range from $4 for stunting to $12 for wasting, $13 for anemia, and $18 for investing in exclusive breastfeeding. Without these investments, the numbers of stunted children will continue to rise in Africa, depriving economies of future growth potential. Mobilizing the required resources for nutrition is possible, but it will require the coordinated efforts of African governments, traditional multilateral and bilateral donors, and innovative sources of financing such as the Power of Nutrition. Over the next 10 years, African governments would need to increase their collective average annual expenditure on nutrition by $0.8 billion, an amount equal to about 2.4 percent of the current government expenditure on health. International donors would need to increase average annual allocations to nutrition in Africa by $1.8 billion, an amount equivalent to about 4.3 percent of total official development assistance (ODA), and innovative financing sources would need to leverage these domestic and ODA resources. The Power of Nutrition is already committed to providing such innovative financing in at least two countries in Africa: Tanzania ($20 million) and Ethiopia ($20 million), with several other African countries in the pipeline.

The regional perspective is followed by country studies for five high-burden countries: Benin, Côte d'Ivoire, Ethiopia, Niger, and Rwanda. Four of these countries (the exception is Benin) are in the first wave countries for the Investing in the Early Years (IEY) initiative. They have stunting rates ranging from 40 percent in Niger to 38 percent in Rwanda and Ethiopia and 30 percent in Côte d'Ivoire. Benin carries a high burden as well, with child stunting rates at 34 percent. Each country study estimates the financing needs and the health, nutrition, and economic impacts of scaling up a set of high-impact nutrition-specific interventions to meet the global nutrition targets. The cost-effectiveness of both the package of interventions as a whole and for each intervention individually is assessed. Finally, two lower-cost financing packages are estimated for each country. In an environment of constrained resources, one of these alternative financing packages could be a strong first investment, but it would need to be followed by increased investments, along with investments in strengthening the national platforms for service delivery, to contribute to meeting the global nutrition targets.

[1]All economic gains reported throughout this report are net gains.

CHAPTER 1:

The Income Elasticity of Stunting Reduction in Sub-Saharan Africa

Introduction

Stunting—being short for one's age—is defined as height-for-age ratio z-score (HAZ) lower than 2 standard deviations below the World Health Organization (WHO) Growth Standard median (WHO 2009). Stunting is a manifestation of chronic malnutrition, resulting from an inadequate quantity and quality of food intake and repeated bouts of infection (WHO 2015). It occurs early in life, with the highest risk during a child's first two years of life, and after that period is largely irreversible (Black et al. 2013). Stunting is associated with weaker immune responses, and stunted children have elevated morbidity and mortality risk. Meta-analytic studies reported that stunted children (HAZ<2) have a two times higher risk and severely stunted children (HAZ<3) a six times higher risk of dying from common childhood infections—including acute respiratory infections, diarrheal disease, and measles—than children who were not stunted (McDonald et al. 2013). It is estimated that malnutrition is an underlying cause of about 45 percent of all deaths in children under age five globally (Black et al. 2008) and that about 14 percent of all deaths of children under five can be attributed directly to stunting (Danaei et al. 2016).

The negative consequences of stunting extend beyond increased mortality and morbidity. Stunted physical growth is strongly associated with slower cognitive development, with delays in school enrollment (Fink et al. 2016), and with lower educational attainment (Adair et al. 2013). Furthermore, stunting has long-lasting economic impact. A recent systematic review showed a 1 centimeter increase in adult height was associated with a median 4 percent increase in wages in men and about a 6 percent increase wages in women, and that the wages of adults who were stunted in childhood were, on average, 20 percent to 40 percent lower than the wages of their peers who were not stunted as children (McGovern et al. 2017). Cohort studies also suggest that adults who were not stunted as children had a 21 percent higher household consumption and a 10 percent lower risk of living in poverty (Hoddinot et al. 2013).

The 2013 Lancet series on maternal and child nutrition presented a conceptual framework describing the causes of malnutrition, including stunting, and strategies to improve it. According to the framework, the direct causes of malnutrition include inadequate food intake (inadequate quantity and quality of food) and repeated bouts of disease that compromise nutrient intake and absorption. The more distal (underlying) causes of malnutrition include food security—that is, food availability and food diversity; access to and use of health services; and a safe and hygienic environment. Finally, the basic causes of malnutrition impacting the underlying and direct causes include macro-level economic, social, political, and environmental factors such as national wealth, poverty and wealth distribution, ubiquity of armed conflict, climate events, and so forth (Walker et al. 2011).

Global Nutrition Targets

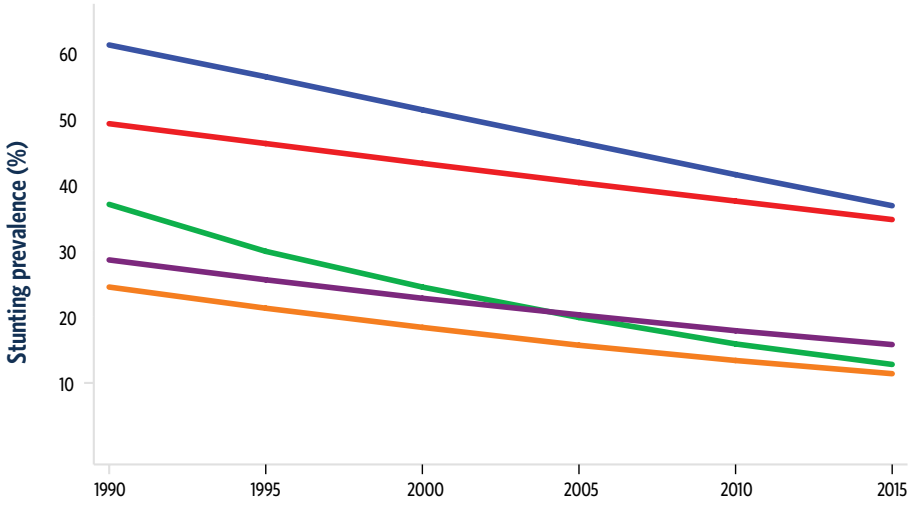
In 2012, the World Health Assembly (WHA) established a set of six global nutrition targets to address key dimensions of maternal and child malnutrition including stunting. The stunting target has subsequently been incorporated into the Sustainable Development Goals (SDG) framework under SDG 2: "End hunger, achieve food security and improved nutrition and promote sustainable agriculture; and SDG target 2.2: By 2030, end all forms of malnutrition, including achieving, by 2025, the internationally agreed targets on stunting and wasting in children under 5 years of age, and address the nutritional needs of adolescent girls, pregnant and lactating women and older persons."[1]

The WHA stunting target calls for reducing the number of children who are stunted worldwide by 40 percent from the 2010 baseline of 171 million to approximately 100 million in 2025. The target is based on an analysis of global trends in the prevalence of stunting among pre-school-age children from 1990 through 2020 (de Onis et al. 2011). In the context of this report it is important to note that the WHA targets, including the stunting target, are set at the global level and are not accompanied by regional or national targets.

Stunting in Sub-Saharan Africa

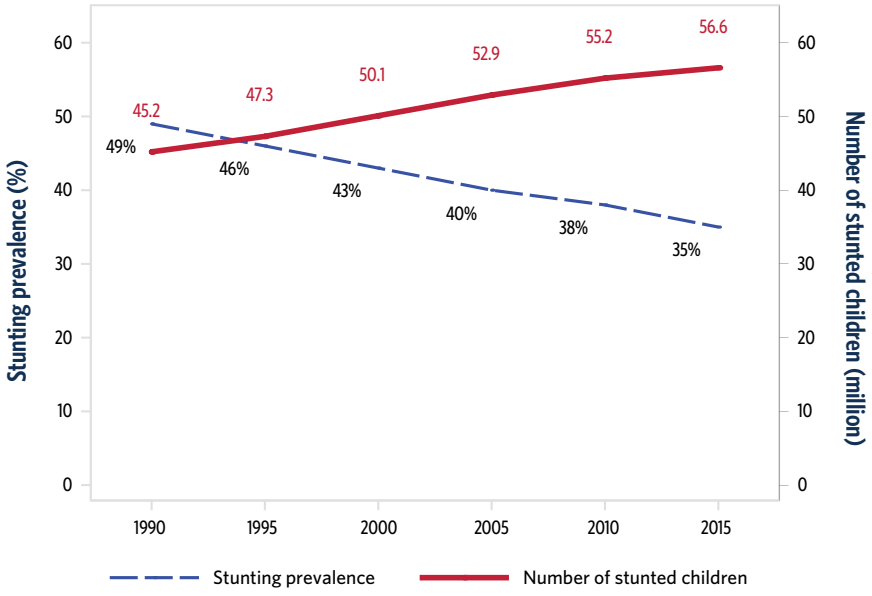
Since 1990, the global prevalence of stunting has declined from 39.5 percent to 22.9 percent and the number of stunted children in the world has declined by over 100 million, from 254 million in 1990 to about 155 million in 2015 (UNICEF, WHO, and World Bank 2017). However, progress in reducing stunting has been slower in Africa than in other regions. Among all World Bank regions, the average annual decline in stunting prevalence has been the lowest in Africa (see **Figure 1.1 and Figure 2.1 on page 27**).

Figure 1.1: Stunting Trends by Region, 1990–2015



Source: UNICEF–WHO–World Bank Joint Malnutrition Estimates, Global Database on Child Growth and Malnutrition (2017)

Figure 1.2: Stunting Prevalence and the Number of Stunted Children in Sub-Saharan Africa, 1990–2015



Source: UNICEF–WHO–World Bank Joint Malnutrition Estimates, Global Database on Child Growth and Malnutrition (2017)

Consequently, although the East Asia and Pacific region managed to reduce stunting prevalence by almost two-thirds, Sub-Saharan Africa (SSA) achieved a reduction of only one-quarter during the same period. Furthermore, because of high fertility and population growth, the number of stunted children on the continent within that time frame increased by about 12 million (see **Figure 1.2**).

If population over that period of time did not grow, rather than the 57 million stunted children currently living in Africa, there would be only about 32 million stunted African children. This suggests that the high rate of population growth alone is responsible for about 24 million cases of stunting in Africa today.

Although there is some variation, in virtually all African countries more than one in five children is stunted, and in nine countries (the Central African Republic, the Democratic Republic of Congo, Eritrea, Ethiopia, Madagascar, Malawi, Mozambique, Niger, and Zambia) stunting prevalence exceeds 40 percent, or two in five children (**see Figure 2.3 on page 27**).

Empirical Evidence

Annex 2 provides a brief overview of the existing empirical evidence by looking at the determinants of undernutrition.

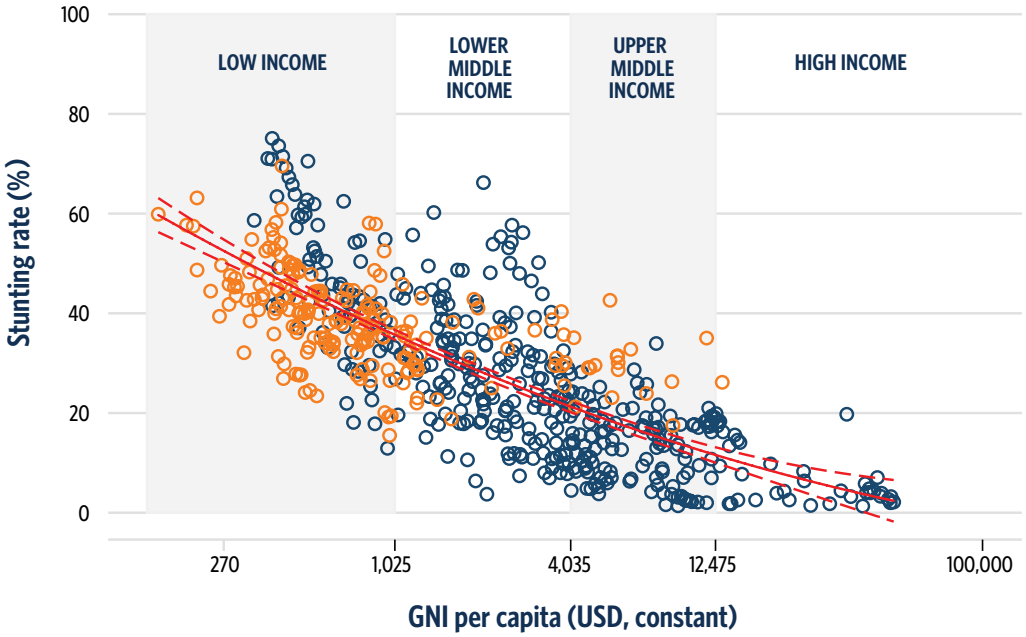
This section of the report focuses on the role of growth in income per capita to contribute to reducing stunting. Estimating the income elasticity of stunting reduction has important policy implications. A low income elasticity of stunting reduction would provide a strong rationale for increasing investments in targeted nutrition interventions to complement broader growth-promoting policies. A substantive body of evidence exists to suggest that a set of *nutrition-specific* interventions is highly cost-effective (Bhutta et al. 2013). The potential to improve nutritional outcomes through *nutrition-sensitive* interventions (i.e., interventions in non-health sectors such as agriculture, social safety nets, early child development, water and sanitation, and schooling) also exists, but the body of evidence to date is not as strong as it is for nutrition-specific interventions (Ruel, Alderman, and The Maternal and Child Nutrition Group 2013).

Overall, the review of existing evidence shows that income per capita has a significant effect on the nutritional status of children (Alderman et al. 2001; Headey 2012; Heltberg 2009; Smith and Haddad 2000, 2002, 2015). Using all available data on stunting and on constant gross national income (GNI) per capita suggests that there is a significant negative relationship between these two variables (**Figure 1.3**). Based on existing cross-country analyses, the estimated income elasticities fall in the range of [−1.26; −0.17] depending on the sample used and the modeling approach adopted (see **Table A.1 in Annex 1**).

Since progress in terms of stunting reduction has been weaker in SSA than it has in other world regions, this analysis looks more closely at the income elasticity of stunting reduction in SSA. One of the key contributions of this section of the report is to test empirically whether the relation between income growth and stunting reduction differs significantly in SSA compared to non-SSA countries. Another contribution is that it assesses the extent to which the estimated income elasticity of stunting reduction differs across SSA subregions and across different levels of stunting. A third contribution of this work is to use the estimated income elasticities and project forward the expected changes in stunting at the 2030 horizon to assess how far SSA countries would lie from the global SDG targets on stunting. A wide range of parametric regression models is adopted to assess the robustness of the results to alternative modeling assumption. In particular, the robustness of the results to potential endogeneity bias using instrumental variables methods is assessed, as well as their robustness to unobserved country-specific heterogeneity by modeling country fixed and random effects.

The dataset is presented in the next section, and the estimation strategy is described in the following one. The subsequent section details the main results, and is followed by a discussion of their implications.

Figure 1.3: Stunting and Income per Capita



Source: World Development Indicators.

The Data

The dataset is constructed at the country-year level, and the primary outcome variable of interest is the prevalence of stunting. Specifically, the stunting rate is the percentage of children under age five whose height-for-age z-score is less than 2 standard deviations below the median of the global reference population of children. Stunting data originating from the Joint Malnutrition Estimates (JME) were prioritized (UNICEF, WHO, and World Bank 2017). This source of data was complemented with data from the World Bank's World Development Indicators (WDI), WHO, or from country Demographic and Health Surveys (DHS) when data points were missing in the JME dataset.

All countries with available data are included, unlike most of the previous studies that focus on developing countries. Several sources of data were explored that contain relevant variables in the following categories: *basic determinants*—macro-fiscal, inclusiveness, governance, and conflicts; and *underlying determinants*—food security and household environment.

The key variables used in this analysis are summarized in Annex 1 in **Table A.1** and **Table A.2**. **Table A.1** includes a detailed definition as well as each variable's source. As specified in the table, most variables come from the World Development Indicators. The government health expenditures, governance, conflict, and food availability indicators originate from other databases that are freely available for public use.

Variables capturing some key elements of the macroeconomic environment, such as the number of economic recessions (episodes for which annual economic growth is negative), the degree of diversification of the economy, the share of natural rents on GDP, and the degree of trade openness are included. On the policy side are variables related to the share of public spending allocated to social sectors (health and education).

Variables related to the degree of inclusiveness—such as the degree of income inequalities (Gini index) and the share of total consumption of the poorest 40 percent of the population—are also included. The female-to-male life expectancy ratio and the proportion of females having completed lower secondary education are also considered.

Indicators capturing different dimensions of the quality of governance and exposure to violence and conflicts are also factored in the analysis.

Finally, variables related to the aggregate food supply are included, as well as those related to the coverage of key interventions such as vitamin A supplementation and improved water and sanitation.

Table A.1 shows the sample mean for each variable of interest, as well as the SSA and non-SSA mean. The mean difference between SSA and non-SSA is formally tested for by using two-sample Student tests. Almost all the variables of interest are shown to be statistically different between the two groups. Overall, **Table A.2** confirms that income is lower, closer, more concentrated (especially in natural rents and in agriculture), more volatile, and less inclusive in SSA than in other regions in the world. Indicators related to the quality of governance are lower in the region and so are coverage of key interventions and aggregate food supply.

Estimation Strategy

The objective of this section is fourfold:

1. Estimate the average income elasticity of stunting for all available country points.

2. Estimate the average income elasticity for SSA countries and test whether this elasticity differs from non-SSA countries.

3. Assess whether the income elasticity differs (i) across SSA subregions and (ii) across countries with different rates of stunting.

4. Assess the extent to which country characteristics contribute to explaining the heterogeneity in estimated income elasticity parameters.

To answer these four questions, the following mixed effects 2-level model specification is used:[2]

$$Ln(Stunt_{irt})=\alpha+\beta_1*Ln(Y_{irt})+\beta_2*Ln(Y_{irt})*SSA+\beta_3*SSA+\beta_4*X_{irt}+\mu_t+u_{i..}+u_{ir.}+\varepsilon_{irt} \quad (1)$$

with

$$u_{i..} \sim N(u_{i..}, \gamma^2) \quad (2)$$

$$u_{ir.} \sim N(u_{ir.}, \tau^2) \quad (3)$$

$$\varepsilon_{irt} \sim N(0,\sigma^2) \quad (4)$$

where

$Ln(Stunt_{irt})$ is the log of the stunting rate in country i, region r in year t;

$Ln(Y_{irt})$ is the log of income per capita expressed in the same constant currency unit across countries;

the dummy variable SSA marks countries belonging to the Sub-Saharan Africa region;

X_{irt} is a set of control variables capturing key country characteristics such as macroeconomic conditions, governance, conflicts, and underlying nutritional determinants;

α, β_1, β_2, β_3, and β_4 are fixed parameters to be estimated;

a random parameter is included to capture unobserved time-invariant heterogeneity at country level ($u_{i..}$);

unobserved heterogeneity at regional level where country effects are nested in region effects;

γ^2, τ^2, *and* σ^2 are the estimated variance residuals for (respectively) the country effect, the regional effect, and the error term;

γ^2 measures the dispersion of the country specific effects around their country specific mean $u_{i..}$; and

τ^2 measures the dispersion of the region effects around their respective means $u_{ir.}$.

A mixed effects multilevel model is chosen because it is the most flexible specification to address the key questions with the data structure at hand (i.e., repeated longitudinal observations for countries that belong to specific regional groups). The empirical strategy used is to first impose specific constraints on the model parameters and then to relax each of these constraints in sequence by testing their significance.

To answer the first question—what is the average income elasticity across all countries?—the following constraints are first imposed on the model: $\beta_2=\beta_3=\beta_4=0$. Since the model is specified in log-log, β_1 can be directly interpreted as the income elasticity of stunting—that is, the average expected percentage change in the dependent stunting rate caused by one percentage change in income.

The second question—what is the average income elasticity for SSA countries, and does this elasticity differ from that of non-SSA countries?—is addressed by relaxing the constraint on β_2 and β_3 and testing whether the resulting income elasticity for the SSA countries differs significantly from the income elasticity estimated for non-SSA countries.

The third question—does the income elasticity differ (i) across SSA subregions and (ii) across countries with different rates of stunting?—is addressed similarly, but instead of creating an interaction variable between the log of income and the whole set of SSA countries, the interactions are constructed with respect to different subregions (south, west, central, and east SSA). To assess the extent to which the estimated income elasticities also vary according to the degree of stunting, the same model is estimated using quantile regressions. The focus is on the 25th percentile, the median, and the 75th percentile, which allows for a test of whether countries with a relatively low incidence of stunting (25th percentile) have different income elasticities than countries with a relatively high incidence of stunting (75th percentile).

Finally, the fourth question—to what extent do country characteristics contribute to explaining the heterogeneity in estimated income elasticity parameters?—is addressed by relaxing the constraint on β_4 and by allowing other control variables to enter the model. Although the constrained model allows the overall income elasticity to be estimated, irrespective of the specific channels through which income causes stunting to change, the unconstrained specification enables an evaluation of how specific characteristics or policy instruments affect stunting, independently of changes in aggregate income.

To examine these four questions, the model is first estimated using pooled ordinary least squares (pooled OLS). This is equivalent to imposing a set of distributional assumptions and parameter constraints on Equation (1). More specifically, the pooled OLS model assumes that $\mu_t=u_{i..}=u_{ir.}=0$, or that the constant α is common across all countries. Under this specification, the error term is supposed to be independently and identically distributed,

and longitudinal observations within countries are supposed to be uncorrelated. Observations related to countries embedded in a similar region are also assumed to be uncorrelated.

Next, these restrictions are relaxed by allowing country-specific and time-invariant effects to be modeled to control for country-specific unobserved heterogeneity. This is done by estimating the main specification using a random effects (RE) model and a fixed effects (FE) model. The main distributional assumption that differs between the random effects and the mixed effects is the correlation between the country effects and the residuals. While the RE model imposes zero correlation between the country effects and the error term, the FE model relaxes this assumption. Another important difference between the FE and the RE models is that the FE model is estimated based exclusively on the within-country (longitudinal) variation in the data. The distributional assumption between the country effects and the error term can be tested empirically using a Hausman test.

Finally, the mixed effects (ME) model allows the estimation to be generalized further by allowing both fixed and random effects to be modeled, and by allowing observation to be correlated across countries within common regional boundaries.

Results

The main variables of interest for the income elasticity estimation are the stunting rates and a measure of income. To measure income, GDP per capita in constant international dollars at 2011 PPP as well as constant GNI per capita are used.[3] The average stunting rate in the sample lies at around 30 percent, and it is significantly higher in SSA (39 percent) than in non-SSA countries (26 percent) (see **Table A.2**).

Pooled OLS-Instrumental Variable Results

Results for the pooled OLS and instrumental variable (IV) results are reported in **Table A.4**. The overall income elasticity is estimated to lie around −0.5. These parameters are estimated first in column (1) and (2). The only difference between these estimates is the fact that column (2) controls for a time trend. It is worth noting that income alone accounts for over 60 percent of the overall variance in stunting. For both variables, the variation in the sample is driven mostly by variation between countries. Within-country variation represents 25 percent or less of total variance in stunting and income. The point estimate suggests that, over the long run, a 10 percent change in GDP per capita is associated with a reduction in stunting of about 5 percent, and the effect is statistically significant.

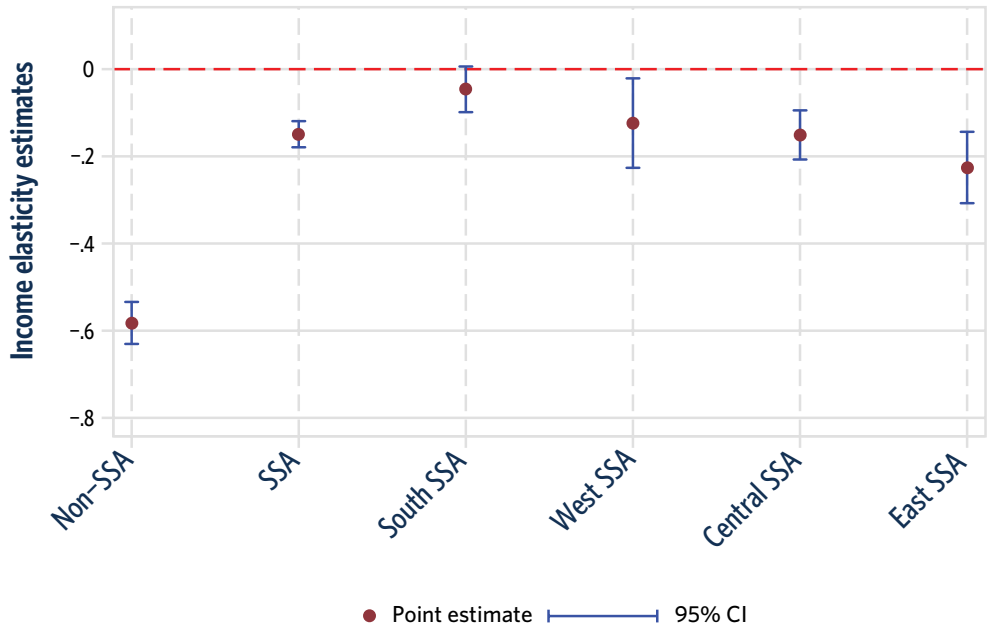
An important issue to consider when estimating the income elasticity of stunting is potential reverse causality. Improvements in stunting rates are indeed expected to contribute to stronger economic growth over the long run (Fogel 1994). Endogeneity would translate into biased estimates of the income elasticity parameter. To address this concern, IV estimates are performed by treating income as an endogenous variable. Money and quasi-money (M2) in percentage of GDP, and the capital share in the economy, are used as instrumental variables.[4] The underlying identification restriction here is that these variables affect stunting only in so far as they influence GDP per capita. The results are reported in column (3) of **Table A.4**. The point estimates for the income elasticity drops slightly but remains significant. Statistical tests are conducted to assess (i) the validity and (ii) the relevance of the instruments. The Sargan-Hansen statistic is reported and the null hypothesis that the instruments are valid cannot be rejected. The under-identification and weak identification tests are rejected, suggesting that the instruments are also relevant and cannot be rejected. Finally, the endogeneity of GDP per capita is tested. Two endogeneity tests are reported in **Table A.4**, and neither can reject the null hypothesis that income per capita is exogenous. The analysis is therefore pursued by assuming that GDP per capita is exogenous.

Next, whether the estimated income elasticity differs between SSA and non-SSA countries is tested. This is done by relaxing the hypothesis that the coefficient associated with the interaction term between (log) GDP per capita and (log) stunting (β_2) is equal to zero. The income elasticity for non-SSA countries is given by β_1 and

the income elasticity for SSA countries by $\beta_1+\beta_2$. The standard errors for the income elasticity in SSA countries is not directly reported by Stata (StataCorp 2015), but can be derived by constructing $std(\beta_1+\beta_2)=\sqrt{[Var(\beta_1)+Var(\beta_2)+2*Cov(\beta_1,\beta_2)]}$. The coefficient of the interaction term is statistically significant, suggesting that the income elasticity of SSA countries differs from that of non-SSA countries (see column (4) of **Table A.4**). The point estimate for the income elasticity in non-SSA countries is −0.57. In SSA countries, the elasticity is still negative, but three times lower (−0.19) in magnitude. This implies that a 10 percent increase in per capita GDP is associated with a 5.7 percent decrease in stunting rates in non-SSA countries, but with only a 1.9 percent decrease in SSA. The same logic is followed in the fifth column of **Table A.4**, but instead of considering the region as a whole, the parameter heterogeneity is assessed at the subregional level. The elasticity for south SSA, west SSA, central SSA, and east SSA is tested to determine whether they differ from that of non-SSA countries. The interaction terms are all statistically significant, suggesting different magnitudes in the income elasticity of stunting between subregions. The region with the lowest response of stunting to changes income is the south SSA region. For the countries in south SSA,[5] a 10 percent increase in GDP per capita is associated on average with a reduction in stunting rates of about 0.9 percent. For countries located in east SSA, however, the point estimate of the income elasticity of stunting lies around −0.24, which is still more than twice as low as it is for non-SSA countries.

Figure 1.4 summarizes the estimated elasticity parameters across regions and subregions, with their associated 95 percent confidence intervals.

Figure 1.4: Estimated Income Elasticity of Stunting (OLS)



Source: Authors calculations from WDI.

Fixed, Random, and Mixed Effects Models

Next, some important assumptions imposed on the model are relaxed by taking into account the structure of the dataset and allowing more flexibility in the estimation. More specifically, first the common intercept assumption imposed by the pooled OLS model to introduce country-specific effects is relaxed. These country-specific effects allow the model to control for any source of unobserved and time-invariant country heterogeneity.

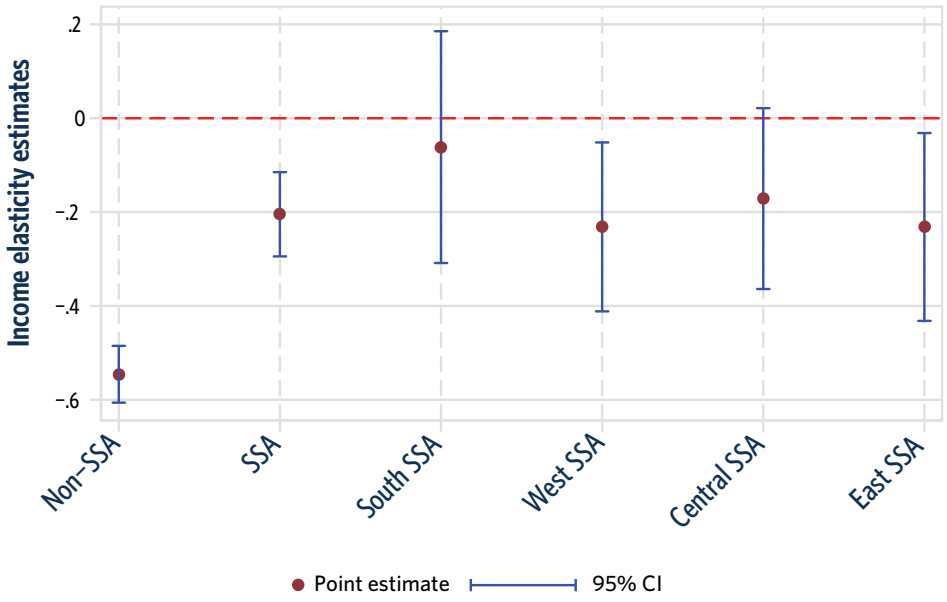
First a random effects (RE) model is estimated; this assumes zero correlation between the country-specific effects and the residuals. The main results for the RE model are reported in column (1) of **Table A.5**. The main coefficients of interest—β_1 and β_2—both remain statistically significant. The point estimates for the non-SSA income elasticity (−0.55) and for the SSA income elasticity (−0.20) are also both statistically significant and are similar to those obtained with pooled OLS regression.

A fixed effects (FE) model is then estimated. This relaxes the zero correlation assumption between the country effects and the residuals. FE models are estimated by taking the first difference of the variables expressed in level. As a result, the estimated elasticities rely on within-country variation only, and can be interpreted as representing short- to medium-term elasticities in comparison to the long-term elasticity estimated in previous models. The non-SSA income elasticity drops to −0.5, and the SSA income elasticity to −0.18 (column (3)). A Hausman test is conducted to assess the validity of the zero correlation assumption imposed under the RE specification. Under the null hypothesis, both the RE and FE estimates are consistent. In that case, the RE estimates are more efficient. Under the alternative hypothesis, however, the RE model delivers inconsistent estimates. The Sargan-Hansen statistic is reported in columns (1) and (2) with their associated p-values. In both cases, the null hypothesis that both models are consistent cannot be rejected.

Finally, the empirical specification is generalized further, and the nested structure of the dataset is factored in by estimating an ME model with nested effects (2-level) in which countries are nested into regions (i.e., non-zero correlation is allowed between countries within the same region). The main results are preserved: the point estimate for the non-SSA income elasticity is around −0.55 and around −0.20 for SSA countries (column (5)).

For all the three panel models considered here, the price to pay for a more flexible set of imposed assumptions is a loss in the precision of estimates. This is visible if the subregional elasticity parameters are considered; these are now not as precisely estimated as they used to be under the pooled-OLS model—see columns (2), (4), and (6). The key result, however—that the income elasticity for SSA countries is negative but substantially lower in magnitude than it is in non-SSA countries—remains robust to changes in the underlying model assumptions. **Figure 1.5** shows the estimated elasticities with 95 percent confidence interval from the mixed effects (ME) model.

Figure 1.5: Estimated Income Elasticity of Stunting (ME Model)



Source: Authors calculations from WDI.

Quantile Regression Results

The analysis of parameter heterogeneity for the income elasticity of stunting is pursued by allowing the estimated parameter to vary with the distribution of stunting. Quantile regression methods are used to ask whether countries with a relatively low incidence of stunting have a different average elasticity than countries with a relatively large incidence of stunting. Quantile regression models are estimated for the 25th percentile of the stunting distribution, its median, and the 75th percentile. The 25th percentile of the stunting distribution regroups countries for which the incidence is lower or equal to 17.4 percent. The median of the distribution is similar to the mean (30.1 percent). Countries with relatively high incidence (75th percentile) are countries for which the rate of stunting is equal to 42.1 percent or more.

The results are reported in **Table A.6** and a similar logic is followed: first a distinct parameter is estimated for SSA as a whole, and then the region is broken down into subregions.

The income elasticity estimates are larger on the lower side of the stunting distribution. For non-SSA, the income elasticity is around −0.66 at the lower part of the stunting distribution (column (1)), and −0.42 at the higher part of the stunting distribution (column (5)). For SSA countries, the elasticity is around −0.22 at the 25th percentile of the stunting distribution, and around −0.16 at the larger part. The median estimates are similar in magnitude to the OLS results (column (3)). Income elasticity estimates for SSA are three times lower than for non-SSA countries for countries with low stunting incidence, and about 2.6 times lower for countries with relatively higher distribution in stunting. As one might expect, disaggregation across moments of the stunting distribution and across SSA subregions yields imprecise estimates, although the point estimates are ranked similarly to the estimated OLS elasticities (columns (2), (4), and (6)).

Augmented Regression Results

Finally, additional control variables are introduced to the main specification to assess the extent to which the difference between the estimated income elasticity in non-SSA countries and in SSA countries can be accounted for by factors related to the different country characteristics that differ significantly between SSA and non-SSA countries (see **Table A.2**) with indicators that characterize the broad macroeconomic environment, the degree of inclusion in the economy, the share of public spending allocated to the social sectors, the quality of governance, the exposition to violence and conflicts, and to coverage of key interventions.

The results for these augmented mixed effects regressions are reported in **Table A.7a** and in **Table A.7b**. In each of these tables, column (1) represents the baseline (no additional control) specification to which subsequent estimates are compared.

Economic diversification, measured by a Herfindhal index based on the share of GDP accounted for by the agriculture, industry, and service sectors, is associated with lower stunting rates, above and beyond the effect of economic diversification on GDP per capita (column (2), **Table A.7a**).

The share of public spending allocated to health and education is also associated with lower stunting rates, after controlling for income (column (4), **Table A.7a**).

Improved food availability and access to improved sanitation induce lower incidence of stunting, still controlling for income differences across countries (columns (7) and (8), **Table A.7a**).

Although some of the additional control variables are associated with changes in stunting rates, the main result remains stable. The income elasticity of stunting is negative, and substantially lower in SSA countries than it is in non-SSA countries. Controlling for access to improved sanitation has the larger effect on the relative magnitude of the estimated income elasticities. Differences in access to water and sanitation account for about half of the gap in income elasticities between non-SSA and SSA countries. By comparison, differences in the degree of economic diversification account for only 6 percent of the difference in income elasticity estimates.

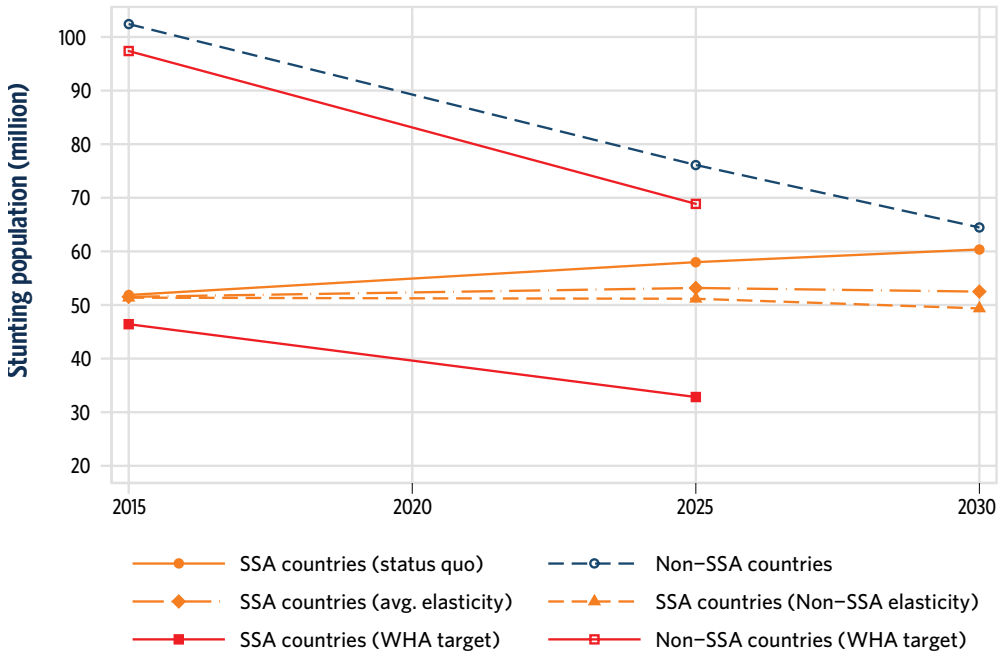
Turning now to governance and exposure to violence and conflicts, **Table A.7b** shows that a lower degree of corruption (column 2), improved government effectiveness (column 3), and a stronger rule of law (column 6) are associated with lower incidence of stunting, independently of the effect of these variables on GDP per capita. An increase in the state fragility index is also associated with higher rates of stunting. Again, controlling for these additional variables does not alter the main result. Differences in the degree of control of corruption and of government effectiveness between SSA and non-SSA countries account for about 20 percent each of the difference in the estimated income elasticity.

Discussion

Using the estimated income elasticity parameters, the expected changes in stunting induced by changes in per capita income are projected forward, using the International Monetary Fund's World Economic Outlook (WEO) projections for GDP growth between 2016 and 2022.[6] These projections are extended to 2030 by estimating a simple Solow growth model and assuming steady state growth. The United Nations Department of Economic and Social Affairs (UN-DESA) World Population Prospects, based on a medium fertility assumption, are used to derive population projections to 2030.

Based on the dataset, the global number of stunted children is estimated to be about 155 million in 2015, 51.9 million of whom (33 percent) are in SSA. Relying on current income and population projections, and applying the estimated income elasticities for SSA and non-SSA countries, the number of stunted children is estimated to decrease in non-SSA countries from 115.8 million in 2010 to about 64.5 million in 2030 (representing a decrease of about 44 percent). For SSA, however, the number of stunted children is estimated to increase slightly to 60.3 million in 2030 (**Figure 1.6**). If the income elasticity of stunting in SSA was equal to the global average (−0.44), then the projected number of stunted children would still remain slightly higher than in 2015 at 52.5 million. Even in the case where the income elasticity of SSA countries was the same as in non-SSA countries (−0.55), the number of stunted children in SSA would fall only slightly below its 2015 level, to 49.3 million, quite far from the implicit WHA target of 33.1 million in 2025.

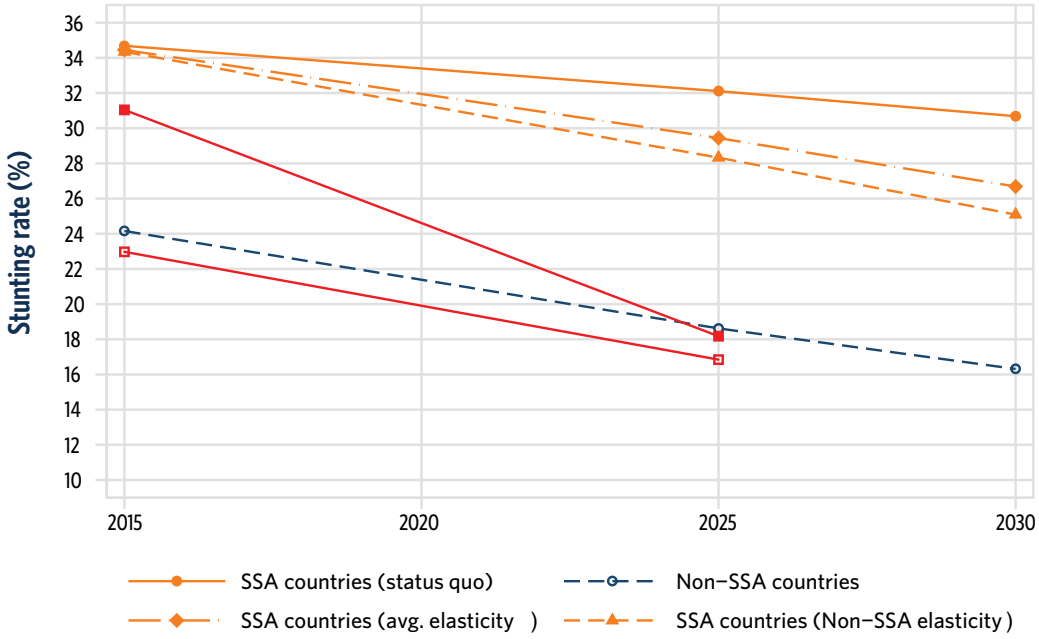
Figure 1.6: Projections of the Number of Stunted Children (SSA versus non-SSA)



Source: Authors calculations from the modeled income elasticities (mixed effects multilevel model). GDP growth projections are taken from the IMF until 2020 and extrapolated using a Solow growth model after. Population projections from UN−DESA World Population Prospects.

These projected trends would correspond to a reduction in the stunting rate in SSA countries from 34.7 percent in 2015 to 30.7 percent in 2030 under a status quo scenario (25 percent if the income elasticity was the same in SSA countries and in non-SSA countries). Again, this is far from the implicit WHA target, which would correspond to a stunting rate of 18.2 percent in 2025 (**Figure 1.7**). For non-SSA countries however, the projected stunting rate for 2030 would fall close to the implicit WHA target of about 16.9 percent (for 2025).

Figure 1.7: Projections of the Stunting Rate, SSA versus non-SSA countries, 2015–30



Source: Authors calculations from the modeled income elasticities (mixed effects multilevel model). GDP growth projections are taken from the IMF until 2020 and extrapolated using a Solow growth model after. Population projections from UN−DESA World Population Prospects.

Conclusion

Income growth is associated with a reduction in stunting. On average, a 10 percent increase in GDP per capita translates into a 4.4 percent decrease in stunting rates. In SSA, however, not only are stunting rates higher and income per capita growth rates lower, but this report shows that the income elasticity of stunting reduction in this region is substantially lower (more than 2.5 times lower) than in non-SSA countries. Although a 10 percent increase in income would be associated with a reduction of about 5.5 percent in the stunting rate in non-SSA countries, the same increase in income would translate into only a 2 percent reduction in stunting in SSA. Moreover, and consistent with the previous result, the income elasticity of stunting is lower in countries where the stunting rate is the highest.

These results have important policy consequences. First, income growth alone will clearly not be sufficient to reach the 2025 target for stunting established in 2012 by the 65th World Health Assembly (WHA) and adopted by the global community for the Sustainable Development Goals (SDGs). Based on estimated elasticity parameters and on current income and population projections, the number of stunted children is expected to *increase* in SSA countries from 51.9 million in 2015 to 60.3 million in 2030, while the implicit WHA target would call for a reduction to about 33.1 million by 2025. Second, these results highlight the importance of scaling up investments in targeted nutrition-specific interventions to accelerate the pace of reduction in stunting worldwide, and even more so in SSA where current coverage of key effective interventions is lower than it is in other regions of the world. Third, these results suggest that relying on income growth alone would not only trigger efficiency concerns for stunting reduction in SSA, but it would also contribute to increasing inequalities in

stunting between countries. Therefore, scaling up targeted nutrition-specific interventions is necessary not only because of an efficiency argument, but also with an objective of reducing inequalities between countries. In addition to bringing nutrition-specific interventions to scale in SSA, a set of nutrition-sensitive interventions might also contribute to the global community target of stunting reduction, especially if one considers the important synergies across sectors to reduce stunting rates (Skoufias et al. 2017).

Endnotes

Note: All dollar amounts are U.S. dollars unless otherwise indicated.

[1] Information about the Sustainable Development Goals can be found at https://sustainabledevelopment.un.org/topics/sustainabledevelopmentgoals .

[2] See Rabe-Hesketh and Skrondal (2012) for a detailed exposition on multilevel and longitudinal modeling.

[3] The results presented in this section of the report are based on GDP per capita. All results were robust to the inclusion of GNI per capita instead of GDP. GDP per capita is used as the main income variable because the implied sample size is larger than if GNI were used.

[4] These are similar to the instruments used for income in Smith and Haddad (2015).

[5] The countries belonging to southern Africa include Botswana, Lesotho, Namibia, South Africa, Swaziland, and Zimbabwe.

[6] See the World Economic Outlook Database, 2017, available at https://www.imf.org/external/pubs/ft/weo/2017/01/weodata/index.aspx.

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CHAPTER 2

INVESTING IN THE EARLY YEARS: *Nutrition in Africa*

Key Messages

- About 56.6 million children under age five in Africa are stunted. If no action is taken, even if the prevalence of stunting remains unchanged, the number of stunted children on the continent will increase by 12 million over the next decade because of the region's high fertility rates.
- Economic growth alone is insufficient to address the challenge of maternal and child malnutrition in Africa. The impact of economic growth on the prevalence of stunting is weaker in Africa than in any other region in the world (a 1 percent increase in gross national income is associated with 0.2 percent reduction in stunting in Africa vs. 0.6 percent in other regions): even among the richest households, as many as one-fifth of children are stunted.
- Scaling up a package of high-impact nutrition-specific interventions in Africa to address the global nutrition targets of stunting, anemia, breastfeeding, and wasting would require on average an additional $2.7 billion per year over the next 10 years and would provide enormous benefits (see panel on right), including preventing nearly 17 million cases of child stunting.
- The economic benefits generated over the productive lives of beneficiaries would be enormous: the region would gain $67 billion from investments in stunting, $16 billion for anemia, $20 billion for breastfeeding, and $13 billion for the treatment of severe wasting.
- Mobilizing the required resources for nutrition is possible but would require the coordinated efforts of African governments, traditional multilateral and bilateral donors, and innovative sources of financing such as the Power of Nutrition. Over the next 10 years, African governments would need to increase their average annual expenditure on nutrition by $0.8 billion, an amount equal to about 2.4 percent of the current government expenditure on health. International donors would need to increase average annual allocations to nutrition in Africa by $1.8 billion, an amount equivalent to about 4.3 percent of total official development assistance (ODA), and innovative financing sources would need to leverage these domestic and ODA resources.
- Returns on every dollar invested in this set of interventions range from $4 for stunting to $12 for wasting, $13 for anemia, and $18 for investing in exclusive breastfeeding.

Benefits of Investing in Nutrition in Africa

✓ **16.9 MILLION**
cases of stunting prevented in 2025

✓ **1.9 MILLION**
child deaths prevented in 2025

✓ **56.9 MILLION**
case-years of anemia in women prevented in 2025

✓ **20.8 MILLION**
babies exclusively breastfed

✓ **11.4 MILLION**
cases of severe wasting treated

$4–$18
return for every dollar invested

$67 BILLION
generated from investments to reduce stunting*

*The economic benefits are calculated over the productive lives of the children benefiting from the interventions that prevent stunting.

Investment Case for Nutrition

Ensuring optimum nutrition—particularly during the 1,000-day period from pregnancy to a child's second birthday—can alter an individual's development trajectory and maximize her or his productive potential. Chronic malnutrition has important lifelong consequences for health and cognitive development. Losses to cognitive development in early childhood resulting from chronic malnutrition are irreversible. Being stunted (low height-for-age) in early childhood is associated with a delayed start at school, reduced schooling attainment, and substantially decreased adult incomes at both the individual and country level (Daniels and Adair 2004; Fink et al. 2016; Hoddinott et al. 2008; Martorell et al. 2010). These consequences add up to overall gross domestic product (GDP) losses of 4 to 11 percent in Africa and Asia (Horton and Steckel 2013). Importantly, chronic undernutrition can be transmitted through an inter-generational cycle, where malnourished mothers are more likely to have stunted children (Aguayo et al. 2016; Ozaltin et al. 2010).

Investments in nutrition are highly cost-effective and among the best value-for-money development actions (Copenhagen Consensus Center 2015; Hoddinott et al. 2013). *An Investment Framework for Nutrition* developed by the World Bank in partnership with R4D, 1000 Days, and the Bill & Melinda Gates Foundation estimated high returns on every dollar invested in nutrition: from $4 in returns for treating acute malnutrition (wasting) to $11 for preventing stunting, $12 for the treatment and prevention of anemia, and $35 for increasing the prevalence of exclusive breastfeeding (Shekar et al. 2017). Not only do investments in nutrition produce substantial economic benefits, but they also lay the groundwork for the success of investments in other sectors.

Investments in the early years—including early life nutrition in the first 1000 days, early learning and stimulation, and nurturing care and protection from stress—ensure that all children reach their human potential and contribute to the economic growth of their nation. The analysis presented below focuses on high-impact nutrition-specific interventions with strong evidence of efficacy in reducing malnutrition, and estimates the costs, impact, and economic benefits of scaling up these interventions in Africa.

Nutrition in Africa

Since 1995, progress in reducing chronic malnutrition and its principal manifestation, stunting, has been slower in Africa than in other regions. Over the past two decades, among all World Bank regions, the Africa region has seen the lowest average annual decline in stunting prevalence (see Figure 2.1). While both the Europe and Central Asia region and the East Asia and the Pacific region have managed to reduce stunting prevalence by almost two-thirds, Africa achieved a reduction of only one-quarter during the same period. Furthermore, because of high fertility and population growth, the number of stunted children on the continent within that time frame actually increased by about 12 million (Figure 2.2) and this upward trend will likely continue in the future. The analyses show that if population growth had declined to zero during this period, the number of stunted children could have declined to 32 million by 2015 instead of increasing to more than 56 million.

Although there is some variation, in virtually all African countries more than one in five children is stunted and in nine countries stunting prevalence exceeds 40 percent, and in another 14 countries – 30 percent. (see Figure 2.3). Furthermore, national prevalence figures mask marked differences within countries, with stunting prevalence in high-prevalence regions being significantly higher than the national average (see chapters 3 to 7 for specific examples).

Household data consistently show that, although stunting prevalence tends to be higher in lower-income quintiles, even among the richest households it is very high, often exceeding 20 percent (Figure 2.4). Recent analyses show that the association between economic growth and reduction in stunting prevalence is weaker in Africa, where a 1 percent increase in per capita gross national income (GNI) is associated with a 0.2 percent reduction in stunting prevalence, than it is in other regions, where the same increase in GNI is associated with a 0.6 percent decrease in the prevalence of stunting (Eozenou et al. 2017). In fact, based on these estimates, economic growth would not be enough to offset the impact of rapid population growth; despite increasing the purchasing power

Figure 2.1: Reduction Rates by Region, 1990–2015

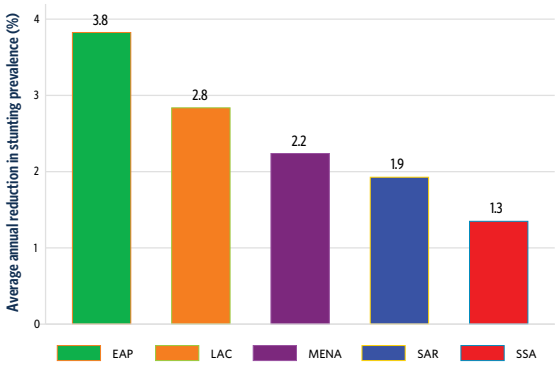
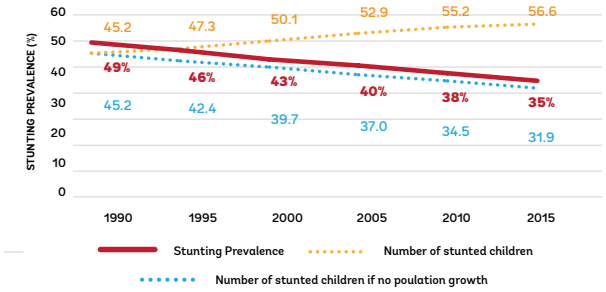


Figure 2.2: Trends in Stunting Prevalence and the Number of Stunted Children in the Africa Region, 1990-2015



Source: UNICEF, WHO and World Bank. 2015

Figure 2.3: Prevalence of Stunting in Sub-Saharan Africa, 2015

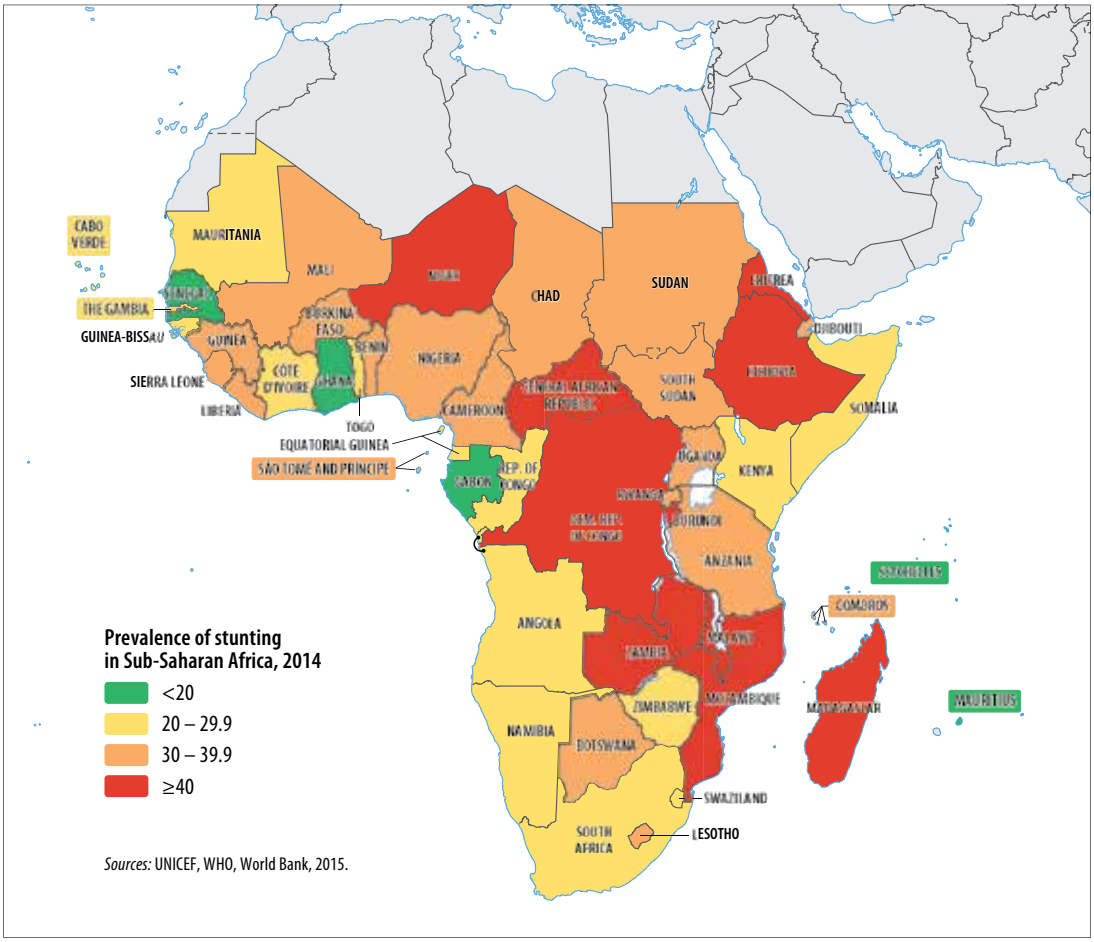


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Figure 2.4: Socioeconomic Disparities in Stunting among Select African Countries

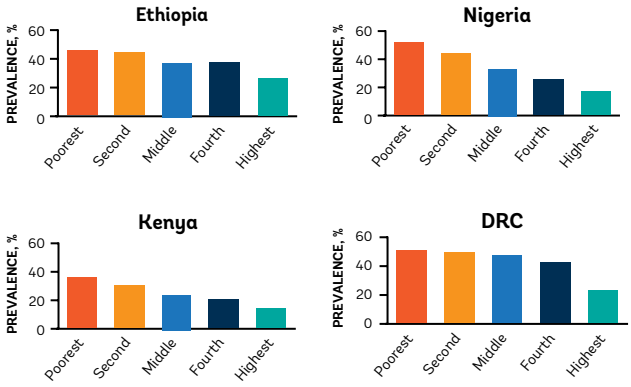
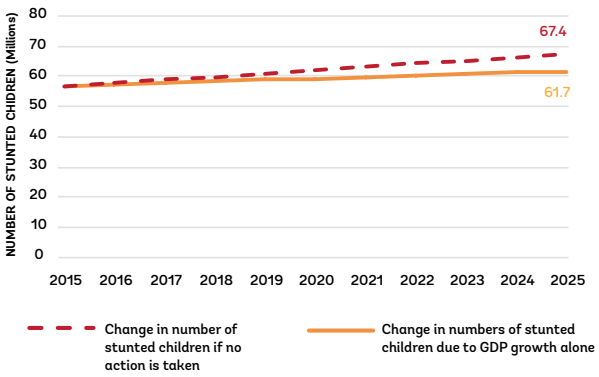


Figure 2.5: Estimated Impact of Economic Growth on the Number of Stunted Children in Africa, 2015–2025



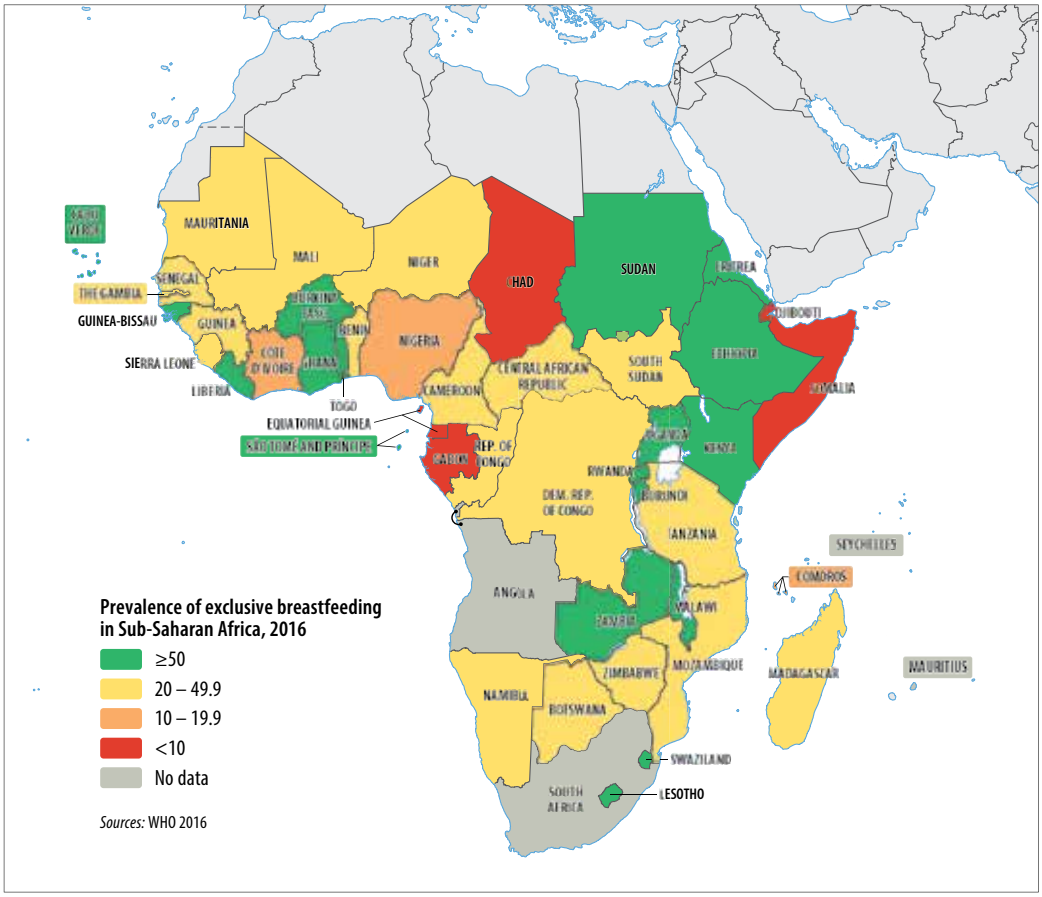
Data source: UNICEF, WHO and World Bank. 2015 and World Bank 2017.

of households, the absolute number of stunted children on the continent would continue to rise (Figure 2.5). This low income elasticity is likely due to the ubiquity of the risk factors—such as food insecurity, lack of access to clean water and improved sanitation, the low socioeconomic status of women, and political instability, among others—which attenuate the impact of higher incomes. At the same time, some countries with relatively low income levels, such as Senegal, have been able to achieve dramatic reductions in stunting prevalence, while relatively rich countries, such as Nigeria, have seen only small declines. In sum, the evidence from within-country and cross-country analyses demonstrates that economic growth alone will not be sufficient to substantially reduce stunting in Africa and that direct action and specific interventions are needed.

Other aspects of malnutrition in Africa are equally alarming. Wasting (low weight for height, an indicator of acute malnutrition) prevalence is higher than in any other region in the world with the exception of South Asia and, in 2015, about 13 million (7.8 percent) of children under age five on the continent suffered from wasting. In a number of countries, largely in the Sahel region (Burkina Faso, Chad, Eritrea, Mali, Mauritania, Niger, Somalia, South Sudan, and Sudan), the prevalence of wasting permanently exceeds the World Health Organization (WHO) public health emergency threshold of 10 percent. Similarly, the prevalence of maternal anemia remains very high—about 40 percent of all pregnant women in Africa are anemic (UNICEF et al., 2015; data from 2011). No recent data exist on the prevalence of other micronutrient deficiencies in Africa. However, the historical data suggest that the prevalence and the associated burden of disease is high. In 2007, about 57.7 million (33 percent) of school-aged children in Africa suffered from iodine deficiency (de Benoits, 2008). In 2005, about 2 percent of all school-aged children in Africa suffered from night blindness as a result of vitamin A deficiency (WHO, 2009). This meant that Africa also had the highest absolute number of children suffering from night blindness – about 2.5 million, roughly half of all children suffering from night blindness worldwide. Similarly, about 3 million (9.8 percent) of pregnant women in Africa were estimated to suffer from night blindness, about a third of the global burden (WHO, 2009).

The prevalence of exclusive breastfeeding tends to be higher in Africa than in other regions. In 18 African countries, more than 50 percent of children are exclusively breastfed (Figure 2.6). However, recent analyses suggest that breastfeeding is inversely associated with income and, as incomes rise, fewer women breastfeed their children (Victora et al., 2016). This in turn implies that, in the absence of interventions aimed at promoting breastfeeding, its prevalence in Africa will decline in the coming years, with a detrimental impact on physical and cognitive development of children on the continent.

Figure 2.6: Prevalence of Exclusive Breastfeeding in Africa



IBRD 42989 | JUNE 2017 This map were produced by the Cartography Unit of the World Bank Group. The boundaries, colors, denominations and any other information shown on these maps do not imply, on the part of the World Bank Group, any judgment on the legal status of any territory, or any endorsement or acceptance of such boundaries.

Global Targets for Nutrition

Substantial improvements in the nutritional status of women and children can be realized if adequate investment is made in a set of evidence-based nutrition-specific interventions that ensure optimum nutrition during the critical 1,000-day window between the start of a woman's pregnancy and the child's second birthday (Black et al. 2008, 2013). For women, these include interventions to prevent anemia before and during pregnancy as well as those aimed at improving protein energy intake during pregnancy. Interventions targeted toward children and their mothers aim to improve breastfeeding and complementary feeding practices, micronutrient status of children, and to treat acute malnutrition in children.

In 2012—to rally the international community around improving nutrition—the 176 members of the World Health Assembly endorsed the first-ever global nutrition targets, focusing on six areas: stunting, anemia, low birthweight, childhood overweight, breastfeeding, and wasting (Table 2.1).[1] These targets aim to boost investments in cost-effective interventions, spearhead better implementation practices, and catalyze progress toward reducing malnutrition. The targets for stunting and wasting are enshrined within the United Nations' Sustainable Development Goal 2 (SDG 2), which commits to ending malnutrition in all its forms by the year 2030.

Table 2.1: Four Global Targets for Nutrition

STUNTING*	**Reduce the number of stunted children under five by 40%**
ANEMIA	**Reduce the number of women of reproductive age with anemia by 50%**
BREASTFEEDING	**Increase the rate of exclusive breastfeeding in the first six months up to at least 50%**
WASTING*	**Reduce and maintain childhood wasting (acute malnutrition) to less than 5%**

Source: WHO 2014.
**Stunting and wasting are included within the United Nations' Sustainable Development Goal 2 (SDG 2), which commits to ending malnutrition in all its forms by the year 2030.*

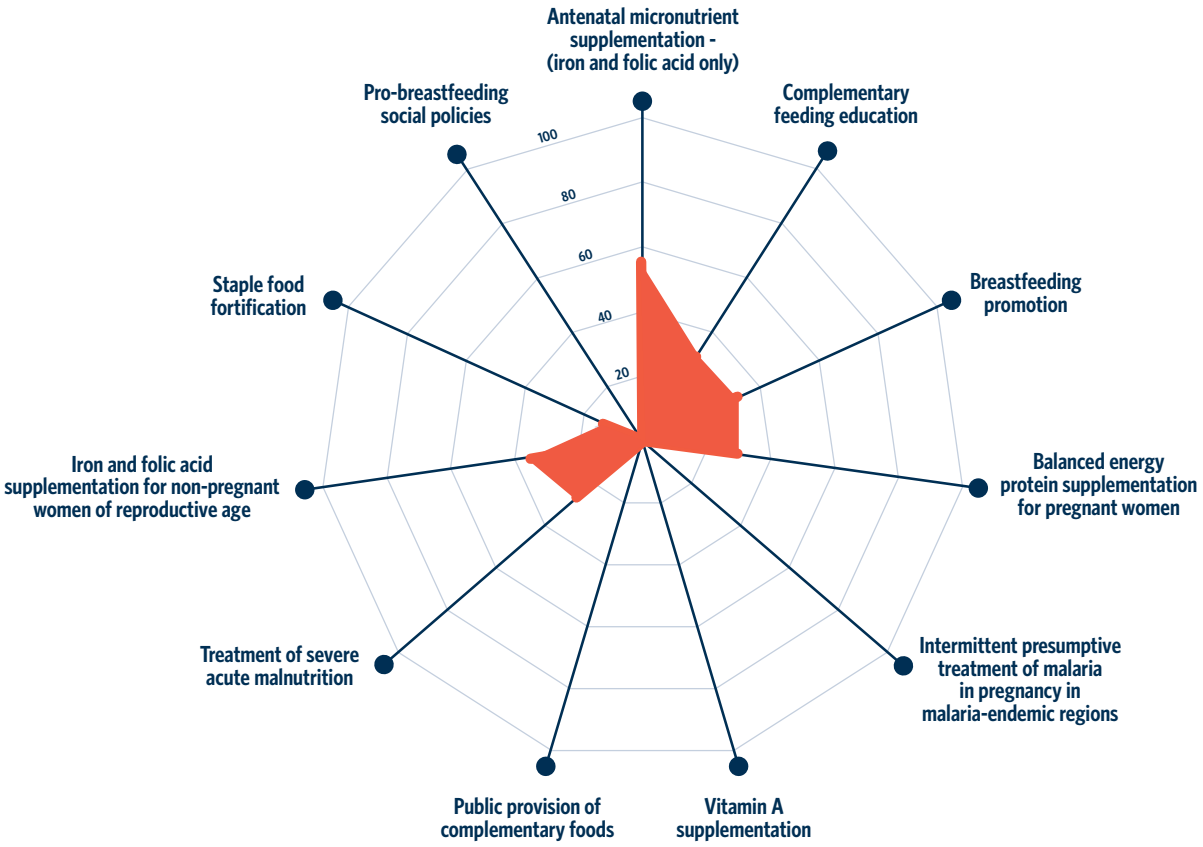
Despite evidence regarding their effectiveness and cost-effectiveness (see the next section), coverage of key nutrition-specific interventions in Africa remains largely inadequate. Although coverage rates are higher for some childhood interventions, they remain well below the levels necessary to progress in reducing malnutrition. Table 2.2 and Figure 2.7 summarize the current coverage of and delivery platforms available for nutrition-specific interventions in Africa.

It should be noted that the analysis presented here does not capture some important, high-impact nutrition interventions, including zinc and oral rehydration solution (ORS) for the treatment of diarrhea, iodization of salt for the prevention of iodine deficiency disorders, calcium supplementation in pregnancy for the prevention of pregnancy-related hypertensive disorders, and others. This is because this report focuses on high-impact interventions with effectiveness ratios for reaching the four specific global nutrition targets adopted by the WHA and included among the SDGs (for stunting and wasting). However, it needs to be noted that addressing malnutrition in a comprehensive manner will require expanding the coverage of those high-impact interventions as well.

Table 2.2: Delivery Platforms for Nutrition-Specific Interventions in Africa

INTERVENTION	PLATFORMS
Antenatal micronutrient supplementation (iron and folic acid only)	Health facility and community
Complementary feeding education	Health facility, community, and communication campaigns
Breastfeeding promotion	Health facility, community, and communication campaigns
Balanced energy protein supplementation for pregnant women	Health facility, community, and social safety net programs
Intermittent presumptive treatment of malaria in pregnancy in malaria-endemic regions	Health facility and community
Vitamin A supplementation	Health facility, community, and food fortification
Public provision of complementary foods	Health facility, community, and social safety net programs
Treatment of severe acute malnutrition	Health facility and community
Iron and folic acid supplementation for non-pregnant women of reproductive age	School, community, health facility, and marketplace
Staple food fortification	Marketplace
Pro-breastfeeding social policies	Government policies
National breastfeeding promotion campaigns	Media

Figure 2.7: Coverage of Key Nutrition-Specific Interventions in Africa, Weighted Average

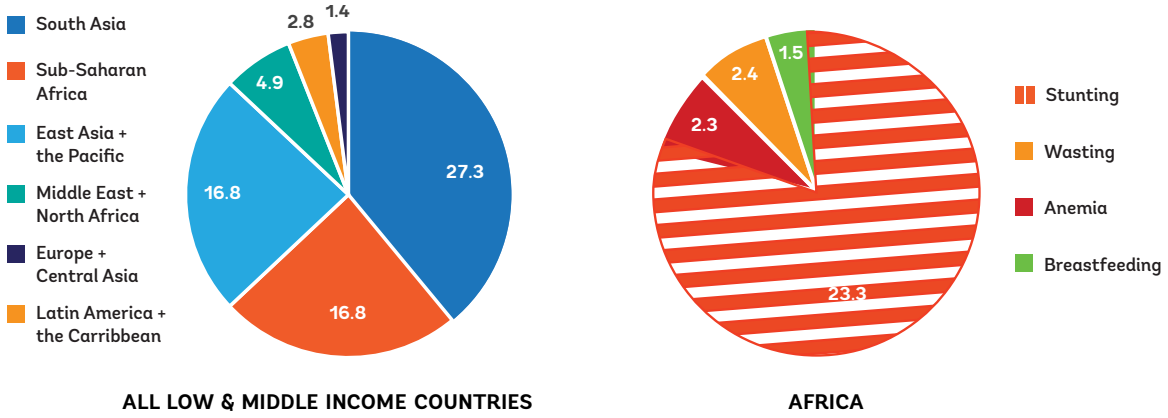


Financing Needs, Impacts, and Cost-Effectiveness of Scaling Up High-Impact Nutrition-Specific Interventions

Using the methodology detailed in *An Investment Framework for Nutrition* (Shekar et al. 2017), this brief presents estimates of the resources needed to scale up a package of 12 high-impact nutrition-specific interventions in Africa to contribute toward achieving the global nutrition targets for stunting, anemia, breastfeeding, and wasting, along with their estimated nutrition, health, and economic impacts.

To scale up the package of key interventions to reach the global nutrition targets, an investment of about $70 billion is needed over the next 10 years, in addition to what low- and middle-income countries currently spend on nutrition. About 39 percent of this total, or an additional $27.4 billion, needs to be invested in Africa. Interventions to reduce stunting will require the most resources, accounting for nearly 80 percent of the total amount required for scale-up. However, some of the stunting interventions would also affect breastfeeding and anemia targets. Figure 2.8 represents the distribution of total cost across interventions to address the four targets.

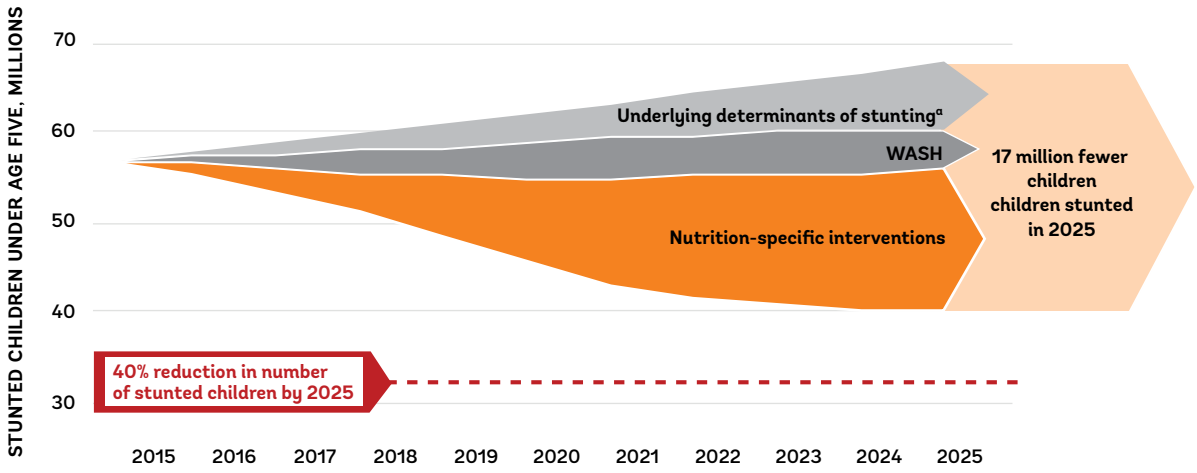
Figure 2.8: Ten-Year Financing Needs to Scale Up Interventions ($, billions)



Note: For Africa, some costs for anemia, breastfeeding, and stunting are shared across interventions.

Combined with investments over the next decade in water and sanitation envisaged under the Water, Sanitation and Hygiene (WASH) SDG goals, and with improvements in other underlying determinants of malnutrition (such as food availability and diversity and women's health, education, and empowerment), investing in the nutrition-specific interventions in Africa would reduce the number of children on the continent who would be stunted in 2025 by 30 percent compared to the 2015 baseline (Figure 2.9). In addition, the scale up of this package of high-impact interventions would prevent over 1.9 million child deaths and 56.9 million case-years of anemia in women of reproductive age. It would also allow the treatment of 11.4 cases of severe acute malnutrition in children and result in 20.8 million of babies being exclusively breastfed.

Figure 2.9: Impact of the 10-Year Scale-Up of Nutrition-Specific Interventions, Africa



Note: a. Includes food availability and diversity, women's education, women's empowerment and health, and water, sanitation and hygiene (WASH).

Among the set of proposed interventions, prophylactic zinc supplementation would be the most effective for stunting reduction, preventing more than 4.8 million cases of stunting over 10 years (Table 2.3). However, it needs to be emphasized that this is an expensive intervention that lacks tested delivery platforms, and WHO has not as yet issued global guidelines for scaling it up, so it will most likely not be possible to deliver it at scale. Vitamin A supplementation and educating mothers about correct complementary feeding practices are the most cost-effective interventions for stunting prevention with a cost per case of stunting prevented of $333 and $429, respectively. Vitamin A supplementation is also the most cost-effective intervention from the point

Table 2.3: Estimated 10-Year Financing Needs and Cost-Effectiveness of Scaling Up Nutrition-Specific Interventions, Africa

INTERVENTION (NUTRITION TARGET)	TOTAL 10-YEAR FINANCING NEEDS (US $M)	COST PER DEATH AVERTED (US $)	COST PER CASE OF STUNTING AVERTED (US $)
For pregnant women and mothers of infants			
Antenatal micronutrient supplementation (stunting, anemia)	1,051	11,815	7,250
Infant and young child nutrition counseling (complementary feeding education and breastfeeding promotion combined)	2,410	6,681	778
Complementary feeding education (stunting)	1,255	13,419	429
Breastfeeding promotion (stunting, breastfeeding)	1,156	4,324	6,491
Balanced energy protein supplementation for pregnant women (stunting)	4,347	45,896	41,123
Intermittent presumptive treatment of malaria in pregnancy in malaria-endemic regions (stunting, anemia)	466	4,981	1,531
For infants and young children			
Vitamin A supplementation (stunting)	327	3,557	333
Prophylactic zinc supplementation (stunting)	5,767	18,420	1,201
Public provision of complementary food (stunting)	8,958	62,902	2,158
Treatment of severe acute malnutrition (wasting)	2,316	4,047	n.a.
For non-pregnant women and general population			
Iron and folic acid supplementation for non-pregnant women (anemia)	119	13,527	n.a
Staple food fortification (anemia)	94		n.a
Pro-breastfeeding social policies (breastfeeding)	30	n.a	n.a
National breastfeeding promotion campaigns (breastfeeding)	193	n.a	n.a
TOTAL:	**27,442**	**19,139**	**1,616**

Note: Financing needs and impacts assume a linear scale-up of interventions from current coverage level to 90 percent over five years, then maintained at 90 percent for an additional five years. Unit costs for each intervention were drawn from available unit costs from neighboring countries, global costs, or estimates available in the literature. The estimated costs include an additional 12 percent (11 percent for pro-breastfeeding social policies and promotion campaigns) to account for monitoring, evaluation, capacity and policy development that may be necessary to reach full scale-up of the interventions. The Lives Saved Tool (LiST; see LiST 2015) was used to estimate the impact of interventions that target pregnant women and children. The impact of interventions that target the general population or non-pregnant women was estimated using a Microsoft Excel model. It should be noted that the LiST model does not capture potential synergies between specific interventions (e.g. the fact that the impact of behavior change communication interventions may be higher in populations that have access to affordable and diversified foods or in populations with higher levels of educational attainment). Therefore, it is possible that the impact estimates generated using LiST in fact underestimate the true impact of the interventions in some contexts.

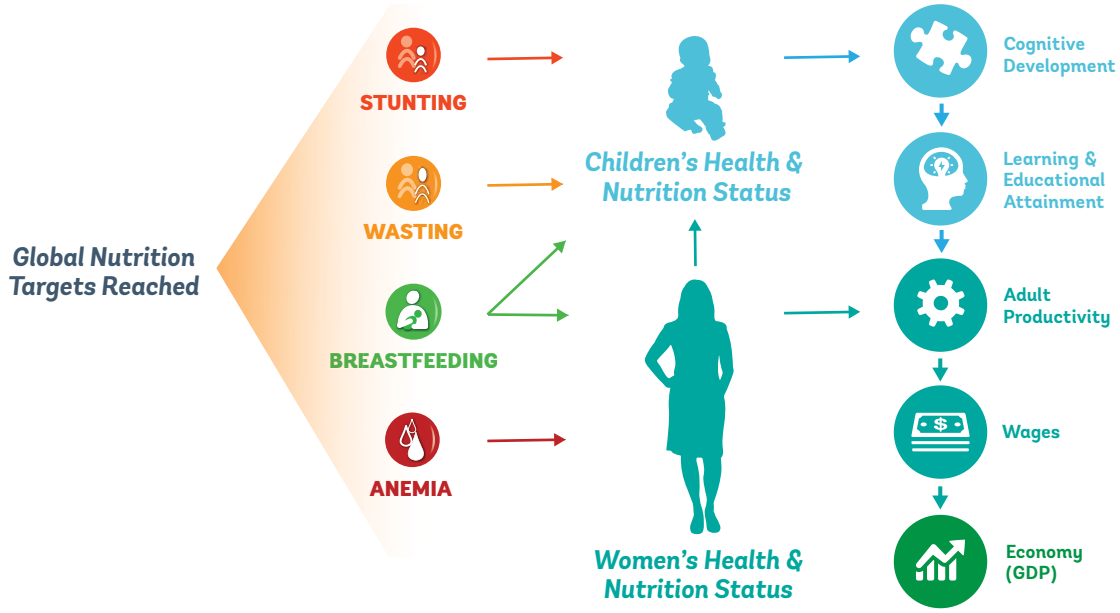
n.a. = not applicable

of view of mortality prevention, with the cost of $3,557 per death prevented. However, its absolute impact is modest because, among other factors, vitamin A supplementation has already been scaled-up in many countries in Africa—the further scale up of vitamin A supplementation to 90 percent coverage would, over 10 years, prevent about an additional 92,000 deaths (about 8 percent of the total mortality reduction from all interventions combined), but it is critical to keep the high coverage rates to prevent back-sliding. Breastfeeding promotion through counseling of mothers is projected to increase the number of infants exclusively breastfed by 20.8 million, and prevent nearly 270,00 deaths. For preventing maternal anemia, blanket iron/folic acid supplementation for all women of reproductive age would be the most cost-effective strategy, at a cost of $2.2 for each case of anemia prevented. However, this intervention, like prophylactic zinc supplementation, currently lacks a delivery platform that would allow to reach all women and therefore cannot be rapidly scaled up. In contrast, fortification of staple foods like wheat and maize is also relatively cost effective, with the cost of $9.9 per case of anemia prevented, but has well established and easily scalable delivery platforms.

Economic Benefits of Investing in Nutrition

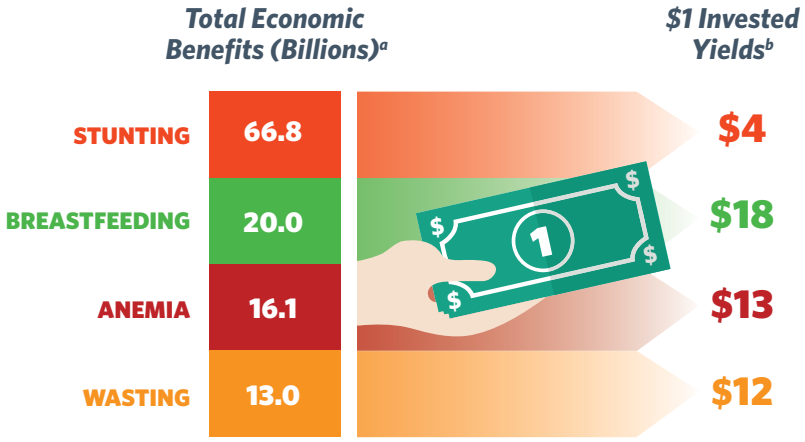
There is a strong body of evidence that shows high economic returns to investing in nutrition (Alderman et al. 2016; Copenhagen Consensus Center 2015; Hoddinott et al. 2013). Scaling up these proven nutrition-specific interventions can ensure that mothers are healthy and well nourished and that they can provide optimal nutrition to their children, that children realize their full physical and cognitive development potential, and that women's productivity is not hampered by illness, especially anemia (Figure 2.10).

Figure 2.10: How Reaching the Global Nutrition Targets Generates Economic Benefits



In Africa, scaling up the package of nutrition-specific interventions would produce substantial economic benefits over the productive lifetimes of the affected women and children (Figure 2.11). Additional health system cost-savings would also be likely because many of these investments reduce the burden of childhood illnesses such as diarrhea and pneumonia.

Figure 2.11: Investments in Africa to Meet the Global Nutrition Targets Have Enormous Economic Returns



a. Total economic benefits over 10 years for women and over the productive lives of children who benefit from these interventions, defined as the period between the age of 18 and a "retirement" age - the life expectancy or the age of 65, whichever is lower.
b. Benefit calculation assumes a 3 percent discount rate for both financing needs and benefits and a GDP growth rate of 3 percent.

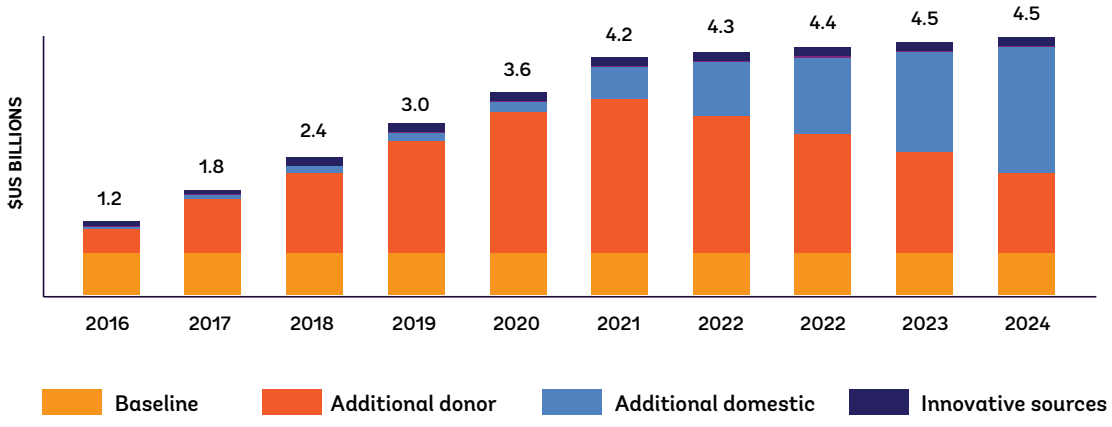
Financing the Scale-Up of Nutrition-Specific Interventions in Africa

The global investment framework estimates that about $0.7 billion is currently allocated to nutrition-specific interventions in Africa (see D'Alimonte et al. 2017 for detailed methodology). This includes allocations from official development assistance (ODA) ($0.55 billion; 79 percent of the total) and from national governments ($0.15 billion; 21 percent of the total).[2] A very small contribution from household purchasing of nutrition commodities was assumed, largely by nonpregnant women above the poverty line for purchase of iron and folic acid supplementation through private retailers. Although most of these costs are borne by the public sector and donors, some scale-up costs would theoretically be offset by household spending over time (see Shekar et al. 2017 for more details). In order to cover the estimated cost of the scale-up, the annual allocation for nutrition from all sources would need to be increased sevenfold (to about $4.5 billion) by 2025 (Figure 2.12). Mobilizing the required resources for nutrition is possible but would require a coordinated effort of African governments, traditional multilateral and bilateral donors, and innovative sources of financing such as the Power of Nutrition initiative.[3] Over the next 10 years, African governments would need to increase their average annual expenditure on nutrition by 0.8 billion, an amount equal to about 2.4 percent of current government expenditure on health. International donors would need to increase average annual allocations to nutrition by $1.8 billion, an amount equivalent to about 4.3 percent of the current ODA contribution and innovative financing sources would need to catalyze these contributions.

The investment framework proposes that, given the current constrained fiscal space for nutrition in Africa, the bulk of the investment would initially come from international donors. In subsequent years, ODA for nutrition would be gradually replaced by domestic resources. According to this financing scenario, in 2025 about 57 percent of the financing would come from domestic public sources, about 40 percent from ODA, and the remaining 3 percent from the innovative financing sources (e.g., the Power of Nutrition initiative and the Global Financing Facility in Support of Every Woman Every Child)[4], and from the households. In order to achieve this level of financing, the average government expenditure for nutrition in Africa would need to reach an amount equivalent to about 7 percent of its current public expenditure on health by 2025. Similarly, but by 2021, the ODA allocated for nutrition would need to reach about 6 percent of the current total ODA and then taper to about 3 percent of ODA.

The World Bank Group is making significant efforts to accelerate nutrition investments under the umbrella of the Investing in the Early Years agenda across the Africa region. Annex 3 provides a list of World Bank Group on-going and planned investments in nutrition as of September 1, 2017.

Figure 2.12: Financing Required to Scale-Up Nutrition-Specific Interventions in Africa, by Source



Source: Regional analysis prepared for D'Alimonte et al. 2017. Note: Annual average household contributions are small relative to other contributions and, as such, are not pictured.

Two Alternative Investment Packages

In an environment of constrained resources in which it will not be possible to raise $27 billion over the next 10 years, two alternative investment packages are laid out for consideration.

The Priority Package: The first—the "priority package"—includes interventions that are the most cost-effective; that is, that have the lowest cost per health outcome (e.g., case of stunting averted), and that have well-established global policy guidelines and delivery platforms. Based on those two criteria, the priority package includes antenatal micronutrient supplementation, infant and young child nutrition counseling, intermittent presumptive treatment of malaria in pregnancy in malaria-endemic regions, vitamin A supplementation, treatment of severe acute malnutrition, intermittent weekly iron and folic acid supplementation for girls 15–19 years of age attending school, and fortification of wheat and maize flour with iron and folic acid. These interventions would be scaled up to full program coverage in the first five years and maintained at full coverage levels for the last five years. This priority package would require an estimated $721 million annually, on average (see Table 2.4).

Table 2.4: Benefits and Cost-Effectiveness by Investment Package, Africa

GLOBAL TARGET	BENEFIT	PRIORITY PACKAGE	CATALYZING PROGRESS PACKAGE	FULL PACKAGE: All interventions needed to meet targets
		7.2 billion over 10 years	**13.1 billion over 10 years**	**27.4 billion over 10 years**
STUNTING	Cases of stunting prevented	5.7 million	9.0 million	16.9 million
ANEMIA	Case-years of anemia in women prevented	39.6 million	52.5 million	56.9 million
BREASTFEEDING	Babies breastfed over 10 years	20.8 million	20.8 million	20.8 million
ALL TARGETS	**Child deaths averted over 10 years**	**1.2 million**	**1.4 million**	**1.9 million**
	Cost per death averted	5,865	9,357	19,139
	Cost per case of stunting averted	1,254	1,456	1,616

a. Total impacts of proposed intervention package combined with other health and poverty reduction efforts.

During the 10 years of scale-up, this package would prevent more than 5.7 million cases of stunting and avert 1.2 million deaths in children under five years of age. It would also prevent more than 39.6 million case-years of anemia in women in 2025 and would result in 20.8 million children under six months of age being exclusively breastfed.

The Catalyzing Progress Package: The second package—the "catalyzing progress package"—includes scale-up of all interventions in the priority package, plus a phased approach to scaling up public provision of complementary foods, balanced energy protein supplementation, prophylactic zinc supplementation, and weekly iron-folic acid supplementation for women outside of schools. It is assumed that, for the latter set of

interventions, during the first five years emphasis will be placed on establishing global guidelines and on operational research to develop effective delivery platforms, or to develop less expensive products or more cost-effective technologies. Costs are approximated as the cost of scaling up this set of interventions from 0 to 10 percent coverage only in the first five years. In the subsequent five years, it is assumed that the coverage expansion of those interventions will accelerate and reach 60 percent by 2025. This package would require, on average, $1.3 billion per year (Table 2.4), a total of $13.1 billion over 10 years. It would prevent 1.4 million deaths and more than 9 million cases of stunting among children under age five, increase the number of exclusively breastfed children under six months of age by 20.8 million, and prevent more than 52.5 million case-years of anemia in women in 2025.

In comparing the relative cost-effectiveness of the three investment packages, the two alternative packages are more cost-effective in preventing deaths and stunting. However, neither is as effective as the full package in making progress toward achieving the stunting, wasting, and anemia targets. The priority and catalyzing progress packages would prevent 1.2 million and 1.4 million deaths respectively, compared with 1.9 million deaths prevented with the full package over 10 years. Under the full package scenario, almost 17 million cases of childhood stunting would be prevented, compared with 9 million cases under the catalyzing progress scenario and fewer than 6 million cases under the priority package scenario. Furthermore, there would be nearly 28 million and 9 million more case-years of anemia prevented in women under the priority package and catalyzing progress package, respectively.

A Call to Action

As the world stands on the cusp of the new Sustainable Development Goals, there is an unprecedented opportunity to save children's lives, build future human capital and cognitive development, and drive faster economic growth. Scaling up key nutrition interventions during the critical 1,000 day window of early childhood will pay lifelong dividends, translating to healthier societies and more robust economies. If this window is missed, it is missed for life.

The additional financing required to reach the global nutrition targets will require coordinated efforts by all stakeholders and a supportive policy environment. To achieve these targets, Africa will need to increase the funding allocated to nutrition by $2.7 billion annually, in addition to the region's current spending. Although this amount may seem high, they are much lower than other types of investments with much lower rates of return. For example, the International Monetary Fund (IMF) estimated that in 2015 alone Africa's governments have spent over $26 billion on fossil fuel subsidies (Coady et al. 2015; Whitley and van der Burg 2015).

Accelerating the reduction of stunting in Africa will be essential for maximizing the return on investments in early childhood development, in education, and more broadly in policies aimed at fostering and enhancing human capital accumulation and job creation. Investing in the early years is even more critical because the Africa region is entering a demographic transition with an expected increase in the working-age population from 54 percent in 2010 to 64 percent in 2090. This creates a golden opportunity for the continent to reap the benefits of the demographic dividend—an acceleration in economic growth resulting from changes in the structure of the population. As a fertility and population growth rates drop and the share of the working-age population rises, the dependency ratio will diminish with a potential to raise per capita output, savings, and investments in human capital.

As mentioned earlier, past high fertility rates in Africa mean that over the last decade, stunting prevalence on the continent has decreased from 49 percent to 35 percent, but despite this, the number of stunted children has increased. If population over that period of time did not grow, rather than nearly 57 million stunted children living Africa currently, there would only be about 32 million stunted children. This suggests that the high rate of population growth alone is responsible for about 24 million cases of stunting in Africa today. Some of the factors that precipitate the demographic transition – access to family planning, later marriage, older age at first birth, longer intervals between births, will contribute to the reduction in child malnutrition (these constitute

some of the so-called nutrition-sensitive interventions). At the same time, however, in order for Africa to reap the benefits of the demographic dividend, it will be imperative to dramatically intensify more targeted efforts to reduce child malnutrition and stunting. The scale-up of the key nutrition-specific interventions is estimated to generate considerable returns in economic benefits over the productive lives of beneficiaries, and is a necessary condition to build human capital through investments in the early years and to harness the potential benefits of the demographic dividend.

Endnotes

Note: All dollar amounts are U.S. dollars unless otherwise indicated.

[1] Two of the global nutrition targets—those for low birthweight and for child overweight—were not included in the analyses because of insufficient data on the prevalence of low birthweight and a lack of consensus on effective interventions to reach the target for child overweight.

[2] Current financing by source is from the Results for Development Institute and can be found at http://www.investinnutrition.org/.

[3] Information about the Power of Nutrition initiative is available at https://ciff.org/grant-portfolio/the-power-of-nutrition/.

[4] More information about the Global Financing Facility in support of Every Woman Every Child program can be found at https://www.everywomaneverychild.org/2014/10/04/global-financing-facility/.

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BENIN: *An Investment Framework for Nutrition*

Key Messages

- Thirty-four percent of children in Benin are chronically malnourished (stunted). Between 2006 and 2014, those in the wealthiest quintiles experienced the fastest rates of decline in stunting prevalence, which remains high across all departments but is highest in Donga, Alibori, and Plateau, where at least half of children under five are stunted.
- Benin has succeeded in reaching the global target for reducing wasting (acute malnutrition) to below 5 percent, and is currently seeing a significant downward trend in stunting prevalence, which dropped from 45 percent in 2006 to 34 percent in 2014.
- Scaling up a package of high-impact nutrition-specific interventions in Benin to contribute toward achieving the global nutrition targets would require an additional $30.9 million per year over 10 years and would yield massive benefits (see panel on the right). These investments are over and above those needed for improving water and sanitation and for addressing issues around women's empowerment and food security.
- This scale-up would require additional financing equivalent to a 16 percent increase in current government health expenditures and could be financed from a combination of domestic budgets, official development assistance (ODA) and innovative financing sources such as the Power of Nutrition.[1]
- The economic benefits generated over the productive lives of beneficiaries from this investment would be $2.8 billion for the prevention of stunting, $1.9 billion for breastfeeding, $455 million for the prevention of anemia, and $272 million for the treatment of severe wasting.
- Returns on every dollar invested in reaching the global nutrition targets range from $14 for stunting and anemia to $23 for wasting and $58 for exclusive breastfeeding.
- To finance the nutrition scale-up, two lower-cost scale up scenarios are estimated to require between $8 and $15 million per year over the next 10 years. In an environment of constrained resources, starting with one of these two scenarios would be a strong first investment, but it would need to be followed by increased investment toward full scale-up to achieve the global nutrition targets.

Benefits of Investing in Nutrition

✓ **179,000**
cases of stunting prevented in 2025

✓ **29,000**
child deaths prevented in 2025

✓ **3.7 MILLION**
case-years of anemia in women prevented in 2025

✓ **433,000**
babies exclusively breastfed

✓ **121,000**
cases of severe wasting treated

$14–$58
return for every dollar invested

$2.8 BILLION
generated from investments to reduce stunting*

**The economic benefits are calculated over the productive lives of the children benefiting from the interventions that prevent stunting.*

Investment Case for Nutrition

Ensuring optimum nutrition—particularly during the 1,000-day period from pregnancy to a child's second birthday—can alter an individual's development trajectory and maximize her or his productive potential. Chronic malnutrition has important lifelong consequences for health and cognitive development. Losses to cognitive development in early childhood resulting from chronic malnutrition are irreversible. Being stunted (low height-for-age) in early childhood is associated with a delayed start at school, reduced schooling attainment, and substantially decreased adult incomes at both the individual and country level (Daniels and Adair 2004; Fink et al. 2016; Hoddinott et al. 2008; Martorell et al. 2010). These consequences add up to overall gross domestic product (GDP) losses of 4 to 11 percent in Africa and Asia (Horton and Steckel 2013). Importantly, chronic undernutrition can be transmitted through an inter-generational cycle, where malnourished mothers are more likely to have stunted children (Aguayo et al. 2016; Ozaltin et al. 2010).

Investments in nutrition are highly cost-effective and among the best value-for-money development actions (Copenhagen Consensus Center 2015; Hoddinott et al. 2013). *An Investment Framework for Nutrition* developed by the World Bank in partnership with R4D, 1000 Days, and the Bill & Melinda Gates Foundation estimated high returns on every dollar invested in nutrition: from $4 in returns for treating acute malnutrition (wasting) to $11 for preventing stunting, $12 for the treatment and prevention of anemia, and $35 for increasing the prevalence of exclusive breastfeeding (Shekar et al. 2017). Not only do investments in nutrition produce substantial economic benefits, but they also lay the groundwork for the success of investments in other sectors.

Investments in the early years—including early life nutrition, early learning and stimulation, and the provision of nurturing care and protection from stress—ensure that all children reach their human potential and contribute to the economic growth of their nation. The analysis presented below focuses on high-impact nutrition-specific interventions with strong evidence of efficacy in reducing malnutrition, and estimates the financing needs, impacts, and economic benefits of scaling up these interventions in Benin.

Country Context

The Republic of Benin is a small coastal country in Sub-Saharan Africa, with a population of almost 10.9 million and a population growth rate of 2.7 percent. Benin has a young population, with approximately 15 percent of the country under age five (UN DESA 2015). Low human capital remains one of the key challenges in reducing poverty and achieving greater socioeconomic equity.

More than half of the population resides in rural areas (World Bank 2016); agriculture accounts for the majority of employment in Benin, with cotton being the primary export commodity. Over 98 percent of young people are employed, largely in the agriculture sector, with less than 8 percent of those between ages 15 and 34 working in non-agriculture salaried jobs (World Bank 2014). Poverty rates are moderately higher in rural areas (39.7 percent) than in urban centers (31.4 percent), and the data show income disparities between districts as well as between rural and urban households. In 2011, 64.4 percent of the rural population subsisted on less than $1.25 per day, nearly double the rate observed in urban areas. Similarly, the poverty headcount in 2011 was estimated at over 75 percent of the population in Atacora compared to 7 percent in Littoral (World Bank 2014).

The Human Development Index (HDI) showed Benin ranked 167 out of 188 countries in 2016 (UNDP 2016). High income inequality exacerbates vulnerability and prevents poor households from meeting basic needs. Child malnutrition, an underlying cause of up to 45 percent of deaths of children under age five (Black et al. 2013), has emerged as one of the key markers of poverty and vulnerability as well as one of the key challenges in ensuring optimal accumulation of human capital in the country.

To address these issues, the Benin government developed the Third Poverty Reduction Strategy (SCRP), covering the period 2011–15. This strategy aimed to improve the quality of life in Benin through health and education and to place the country on the road to emerging-market status by 2025 by strengthening human capital (as its third pillar) and making gains toward sustainable regional development (as its fifth pillar) (IDA and IMF 2011). Progress has been made in reducing total fertility rates (TFR) in Benin, which through the 1990s was up above 6.0 and is now declining, with a current TFR of 4.8. Declining TFR can be a positive contributor to improved health and nutrition outcomes (World Bank 2016).[3]

Nutritional Status in Benin

Persistently high rates of undernutrition remain a serious human development challenge in Benin. More than a third of children (34 percent) under five years of age are stunted and 4.5 percent are wasted (low weight-for-height) (UNICEF 2015). Between 1996 and 2006, data from Benin Demographic and Health Surveys (BDHS) showed an increasing trend in stunting prevalence, from 39.1 percent to 44.7 percent. However, the latest data from the 2014 Benin Multiple Indicator Cluster Survey (MICS) showed promising declines in both chronic and acute malnutrition (Figure 3.1), albeit the different surveys—BDHS and MICS—may not be comparable because of their varying methodologies. Nevertheless, Benin ranks 103rd of 130 countries ranked from lowest to highest stunting prevalence (IFPRI 2016).

National estimates mask socioeconomic and geographic and disparities in stunting prevalence. Significant differences in stunting prevalence remain among children in poorer and wealthier households, and similarly among children in rural and urban households. Between 2006 and 2014, stunting declined at a faster rate among children living in households in the wealthiest quintile when compared with those in the poorest quintile (Figure 3.2). In the wealthiest households, nearly one in five children is stunted, as compared to the poorest quintile where almost half of children are stunted. Not only was the decline less dramatic among children in the poorest quintile but rates of stunting in this group remain much higher in 2014 as compared with 1996 (46 percent versus 36 percent).

The highest stunting prevalence rates are concentrated in the north where two departments have stunting prevalence of over 40 percent (Figure 3.3). This is in stark contrast to the stunting prevalence in the southernmost department, Littoral, at 17.8 percent. Given the regional variation in stunting prevalence, it would be important to understand the key drivers of undernutrition in these highest prevalence regions, and to design targeted interventions to address them.

Figure 3.1: Trends in Undernutrition in Benin, 1996–2014

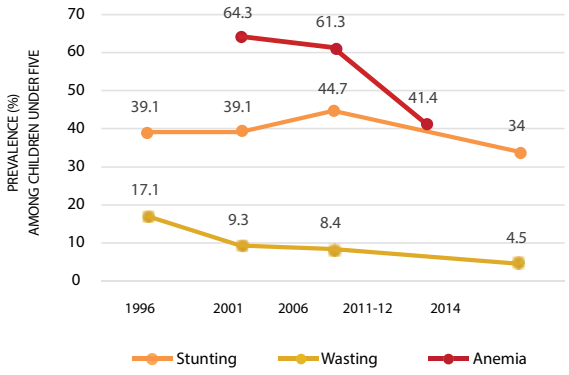
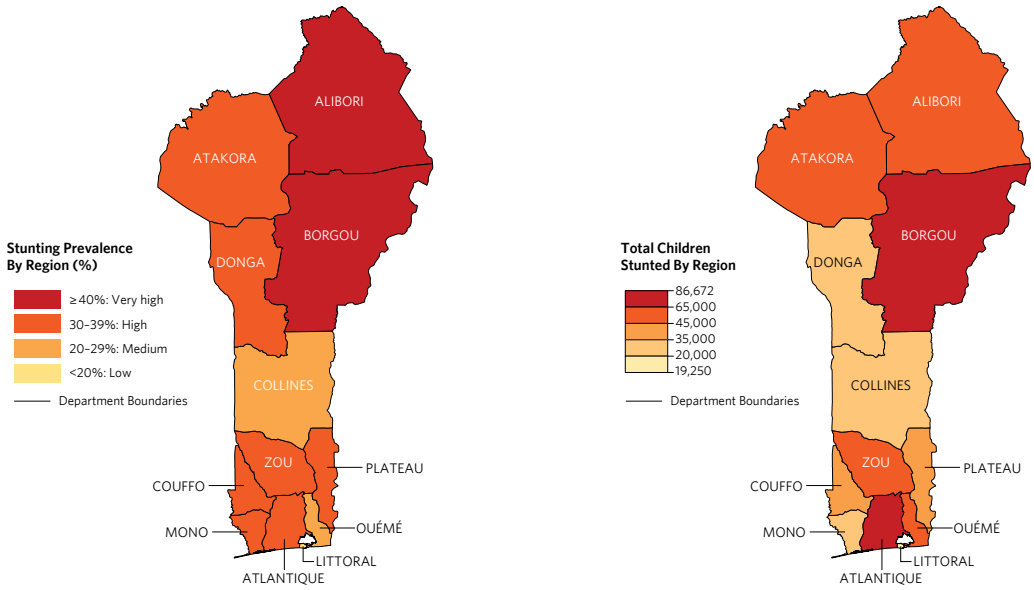


Figure 3.2: Disparities in Stunting by Wealth Quintile, 1996–2014

Sources for Figures 3.1 and 3.2: BDHS for 1996, 2001, 2006, and 2011–2012; Benin MICS 2014

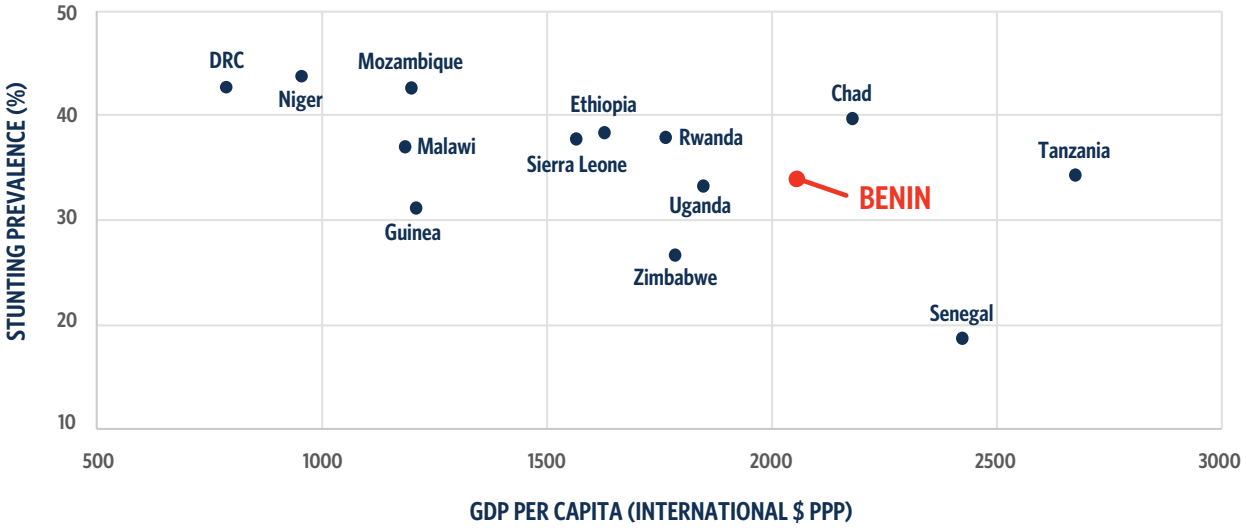
Figure 3.3: Number of Stunted Children and Stunting Prevalence in Benin by Region, 2014–2015



Data source: Benin MICS 2014. IBRD 42940 | MAY 2017 These maps were produced by the Cartography Unit of the World Bank Group. The boundaries, colors, denominations and any other information shown on these maps do not imply, on the part of the World Bank Group, any judgment on the legal status of any territory, or any endorsement or acceptance of such boundaries.

The prevalence of stunting in Benin is comparable to the average in the region (35.2 percent) (World Bank 2017). Nevertheless, some African countries with lower per capita income—such as Guinea, Uganda, and Zimbabwe—exhibit similar or lower prevalence of child stunting, which belies the fact that economic development needs to be coupled with other investments to attain improvements in childhood nutrition (Figure 3.4).

Figure 3.4: Prevalence of Stunting and GDP per Capita: Benin and Selected Low-Income Countries



Sources: Benin MICS 2014; World Bank 2017.

Wasting, also known as acute malnutrition, is typically classified as either severe or moderate. Wasting can result from food insecurity in resource-poor settings with insufficient dietary quality, quantity and diversity, suboptimal breastfeeding, and recurrent episodes of illness such as diarrhea. Wasting prevalence across Sub-Saharan Africa is second highest in the world, after South Asia, with 13 million children (7.8 percent) suffering

from acute malnutrition. However, this varies at country level. In 2014, Benin exceeded their goal to reduce wasting to under 5 percent with a downward trending wasting prevalence of 4.5 percent (Benin MICS 2014).

Micronutrient deficiencies (a form of malnutrition that relates to a deficiency in essential vitamins and minerals needed for body functions and is sometimes referred to as *hidden hunger*) are highly pervasive in Benin. Anemia, a condition caused by inadequate dietary intake of iron, helminth infections, and malaria, among other causes, has cross-generational impacts. Approximately 41 percent of women of reproductive age in Benin are anemic (BDHS 2011–2012), which affects not only women's own health, but also contributes to the intergenerational cycle of undernutrition. Over half (58 percent) of children aged 6 to 59 months are anemic, with one department having an anemia prevalence of over 85 percent (BDHS 2011–2012). Although overall anemia has declined significantly from more than 80 percent in 2001 (BDHS 2001), largely as a result of malaria prevention measures, maintaining and promoting dietary diversity with iron-rich foods to prevent micronutrient deficiencies in women of reproductive age is essential to set the stage for their children to achieve optimal nutrition and development.

Benin has made some gains in child survival and maternal health, including reduced maternal and child mortality ratios and improvements in the essential package of services for maternal and newborn health, such as deliveries in a health facility, but significant challenges remain in improving nutrition outcomes and addressing the multiple determinants of undernutrition. At the underlying level, stunting in Benin is associated with insufficient access to a nutritionally rich and diverse diet, inadequate hygiene and sanitation practices, and suboptimal care and feeding practices, among other causes. Demand- and supply-side barriers influence optimum feeding practices such as breastfeeding, appropriate food consumption, and dietary diversity. An analysis conducted in 2014 looked at household surveys and found that 11 percent of households were food insecure, with the Couffo, Mono, and Atacora departments experiencing the highest prevalence of food insecurity (exceeding 25 percent of households) (WFP 2014). Similarly, the rate of food insecurity is estimated to be twice as high in rural areas (approximately 15 percent) as in urban settings (8 percent). Households with poor food consumption were found to have a limited diversity of diet, which consisted mainly of cereals and starchy roots. More than 85 percent of families are dependent on markets, making them vulnerable to climatic and economic shocks as well as seasonal and price fluctuations. The increase in market rate for staple crops in times of crisis translates to a reduction in purchasing power for the most vulnerable families (WFP 2014). Recognizing that factors other than poverty and food insecurity put children at risk of chronic malnutrition, effective multisectoral strategies are needed to address undernutrition across the country.

Political Commitment to Reduce Malnutrition

The policy environment around nutrition is gaining momentum in Benin. For several decades the institutional leadership responsible for implementing and overseeing nutrition policies moved between various ministries. In 2007, Benin, with the support of the World Bank, undertook reforms related to food and nutrition. Since 2009, Benin has adopted several nutrition-specific policies and plans, beginning with the Strategic Plan for Food and Nutrition Development (PSDAN) and the National Policy for the Protection, Encouragement, and Promotion of Breastfeeding (UN SCN Secretariat 2013).

Following on these achievements, Benin established a multisector national Council on Food and Nutrition (CAN) platform in 2011 to bring together all sectors involved in nutrition to improve food, health, and nutrition outcomes. CAN is attached to the Presidency of the Republic and fosters synergies between nutrition research and policy recommendations (SUN 2016). Also in 2011, Benin joined the SUN movement, solidifying the country's commitment to ending malnutrition.

Food and nutrition is increasingly seen as a development priority at the commune level as well, evidenced by the integration of nutrition within the National Association of Communes of Benin (ANCB) support funds. Benin is implementing a common results framework to align actions to address chronic malnutrition at the commune level (SUN 2016).

Benin has also integrated nutrition within agriculture policy by establishing the Law on Agriculture and Food and Nutrition Security (SUN 2016). The growing association of nutrition and agriculture is further grounded in the Actions for Environment and Development (ACED) strategic plan, which includes an arm designed to improve nutrition security of vulnerable communities by adapting agriculture production to nutrition needs (AECD-Benin, No date).

Current Financing for Nutrition

In 2015 in Benin, the government and foreign donors spent a total of $1.64 million on interventions that will contribute to reaching the global targets for nutrition.[2] Of that amount, $383,000 came from the government and $1.26 million came from ODA. This contribution from ODA included $876,000 for stunting, $106,000 for anemia, $183,000 for breastfeeding, and $256,000 for wasting.[3] These estimates reflect the current spending on nutrition, and the following sections detail additional financing needed in order for Benin to contribute to reaching the global targets on nutrition.

Global Targets for Nutrition

Substantial improvements to the nutritional status of women and children can be realized if adequate investment is made in a set of evidence-based nutrition-specific interventions that ensure optimum nutrition during the critical 1,000-day window between the start of a woman's pregnancy and the child's second birthday (Black et al. 2008, 2013). For women, these include interventions to prevent anemia before and during pregnancy as well as those aimed at improving protein energy intake during pregnancy. Interventions targeted toward children and their mothers aim to improve breastfeeding and complementary feeding practices, enhance the micronutrient status of children, and treat acute malnutrition in children.

In 2012—to rally the international community around improving nutrition—the 176 members of the World Health Assembly endorsed the first-ever global nutrition targets, focusing on six areas: stunting, anemia, low birthweight, childhood overweight, breastfeeding, and wasting. These targets aim to boost investments in cost-effective interventions, spearhead better implementation practices, and catalyze progress toward reducing malnutrition. The targets for stunting and wasting are enshrined within the United Nations' Sustainable Development Goal 2 (SDG 2),

Table 3.1: Four World Health Assembly Targets for Nutrition and Benin's Contribution toward Meeting Them

		RANK	PREVALENCE	PROGRESS
1 STUNTING*	Reduce the number of stunted children under five by 40%	103/132	34	●
2 ANEMIA	Reduce the number of women of reproductive age with anemia by 50%	177/185	41.4	●
5 BREASTFEEDING	Increase the rate of exclusive breastfeeding in the first six months up to at least 50%	55/141	41.4	●
6 WASTING*	Reduce and maintain childhood wasting (acute malnutrition) to less than 5%	64/130	4.5	●

LEGEND: ● Off course, no progress ● Off course, some progress ● On course, good progress

**Stunting and wasting are included within the United Nations' Sustainable Development Goal 2 (SDG 2), which commits to ending malnutrition in all its forms by the year 2030.*
Sources: Nutrition targets from WHO 2014; Rank and progress from IFPRI 2016; Prevalence data from BDHS 2011-2012.

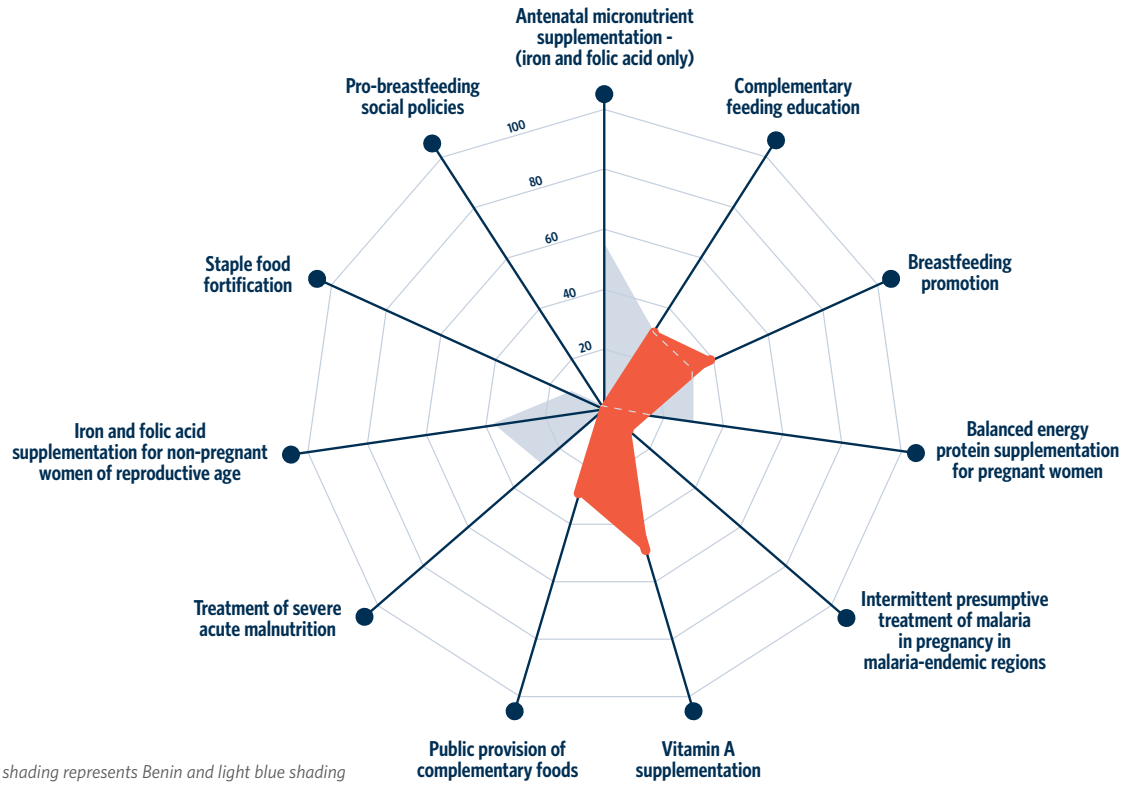
which commits to ending malnutrition in all its forms by the year 2030. The 2016 Global Nutrition Report ranked each country's progress in contributing toward achieving the global targets (Table 3.1) (IFPRI 2016).[4]

Coverage of key nutrition-specific interventions in Benin is low and remains well below the levels necessary to advance progress in reducing malnutrition among Beninese children. Table 3.2 and Figure 3.5 summarize the current coverage of and delivery platforms for nutrition-specific interventions in Benin.

Table 3.2: Delivery Platforms of Nutrition-Specific Interventions in Benin

INTERVENTION	PLATFORM
Antenatal micronutrient supplementation (iron and folic acid only)	Health facility and community
Complementary feeding education	Health facility, community, and communication campaigns
Breastfeeding promotion	Health facility, community, and communication campaigns
Balanced energy protein supplementation for pregnant women	Health facility, community, and social safety net programs
Intermittent presumptive treatment of malaria in pregnancy in malaria-endemic regions	Health facility and community
Vitamin A supplementation	Health facility, community, and food fortification
Public provision of complementary foods	Health facility, community, and social safety net programs
Treatment of severe acute malnutrition	Health facility and community
Iron and folic acid supplementation for non-pregnant women of reproductive age	School, community, facility, and marketplace
Staple food fortification	Marketplace
Pro-breastfeeding social policies	Government policies
National breastfeeding promotion campaigns	Media

Figure 3.5: Coverage of Key Nutrition-Specific Interventions: Benin and Sub-Saharan Africa

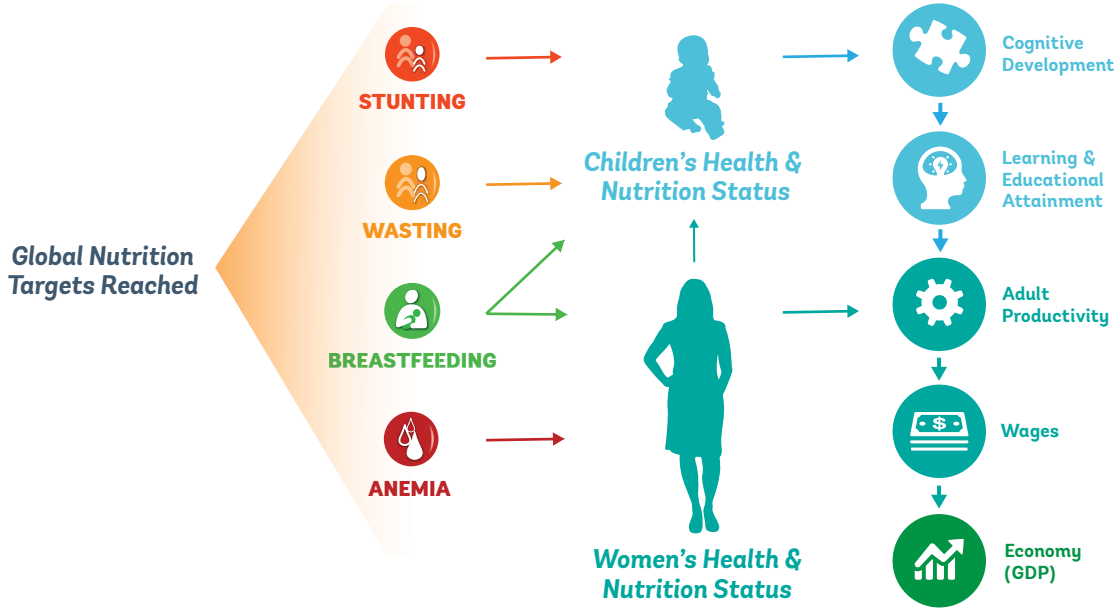


Note: Red shading represents Benin and light blue shading represents average Sub-Saharan Africa coverage

Economic Benefits of Investing in Nutrition

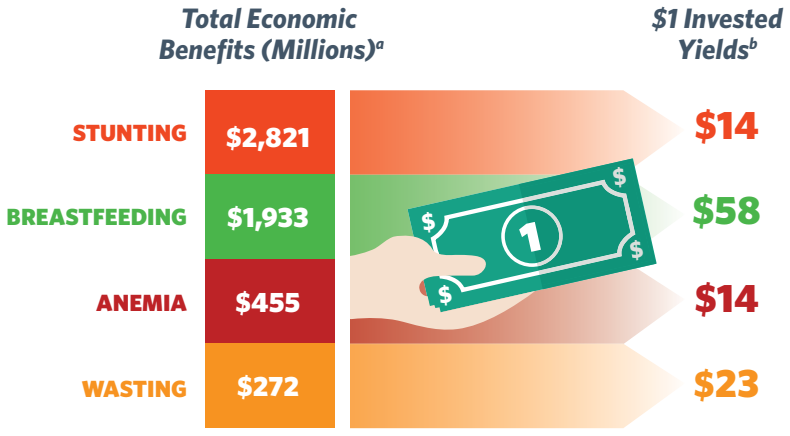
There is a strong body of evidence that shows high economic returns to investing in nutrition (Alderman et al. 2016; Copenhagen Consensus Center 2015; Hoddinott et al. 2013). Scaling up these proven nutrition-specific interventions can ensure that mothers are healthy and well nourished, that they can provide optimal nutrition to their children, that children realize their full physical and cognitive development potential, and that women's productivity is not hampered by illness, especially anemia (Figure 3.6).

Figure 3.6: How Reaching the Global Nutrition Targets Generates Economic Benefits



In Benin, scaling up the package of nutrition-specific interventions would produce substantial economic benefits over the productive lifetimes of the affected women and children (Figure 3.7). Additional health system cost-savings would also be likely because many of these investments reduce the burden of childhood illnesses such as diarrhea and pneumonia.

Figure 3.7: Investments in Benin to Meet the Global Nutrition Targets Have Enormous Economic Returns



a. Total economic benefits over 10 years for women and over the productive lives of children who benefit from these interventions, defined as the period between the age of 18 and a "retirement" age - the life expectancy or the age of 65, whichever is lower.

b. Benefit calculation assumes a 3 percent discount rate for both financing needs and benefits and a GDP growth rate of 3 percent.

Financing Needs, Impacts, and Cost-Effectiveness of Scaling-Up Nutrition-Specific Interventions

Using the methodology detailed in *An Investment Framework for Nutrition* (Shekar et al. 2017), this brief presents estimates of the resources needed to scale up a package of high-impact nutrition-specific interventions in Benin to meet the global nutrition targets for stunting, anemia, breastfeeding, and wasting, along with their estimated nutrition, health, and economic impacts. An additional $30.9 million per year over 10 years is needed to scale up the package of key interventions (Table 3.3). The health and nutrition impacts of this investment are shown in Table 3.4.

Table 3.3: Estimated 10-Year Financing Needs and Cost-Effectiveness of Scaling Up Nutrition-Specific Interventions, Benin

INTERVENTION (NUTRITION TARGET)	TOTAL 10-YEAR FINANCING NEEDS (US $M)	COST PER DEATH AVERTED (US $)	COST PER CASE OF STUNTING AVERTED (US $)
For pregnant women and mothers of infants			
Antenatal micronutrient supplementation (stunting, anemia)	9.1	68,675	49,673
Infant and young child nutrition counseling (complementary feeding education and breastfeeding promotion combined)	21.0	2,255	501
Complementary feeding education (stunting)	11.0	4,799	284
Breastfeeding promotion (stunting, breastfeeding)	9.9	1,419	3,282
Balanced energy protein supplementation for pregnant women (stunting)	41.8	24,602	25,721
Intermittent presumptive treatment of malaria in pregnancy in malaria-endemic regions (stunting, anemia)	6.8	3,330	1,144
For infants and young children			
Vitamin A supplementation (stunting)	2.7	1,317	184
Prophylactic zinc supplementation (stunting)	66.2	13,255	1,254
Public provision of complementary food (stunting)	104.7	33,321	1,930
Treatment of severe acute malnutrition (wasting)	14.6	3,338	n.a
For non-pregnant women and general population			
Iron and folic acid supplementation for non-pregnant women (anemia)	13.8	41,926	n.a
Staple food fortification (anemia)	3.7		n.a
Pro-breastfeeding social policies (breastfeeding)	5.0	n.a	n.a
National breastfeeding promotion campaigns (breastfeeding)	20.0	n.a	n.a
TOTAL:	**309.3**	**10,465**	**1,455**

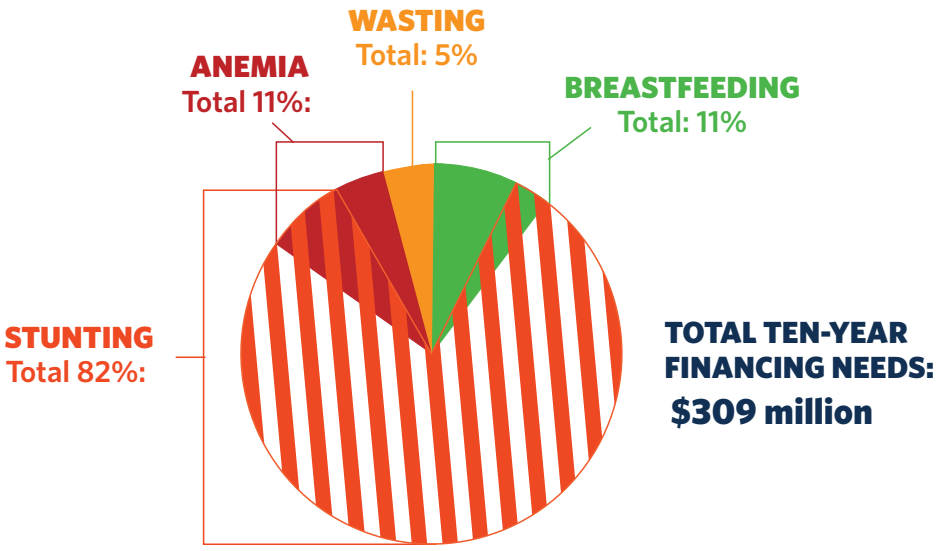
Note: Financing needs and impacts assume a linear scale-up of interventions from current coverage level to 90 percent over five years, then maintained at 90 percent for an additional five years. Unit costs for each intervention were drawn from available unit costs from neighboring countries, global costs, or estimates available in the literature. The estimated costs include an additional 12 percent (11 percent for pro-breastfeeding social policies and promotion campaigns) to account for monitoring, evaluation, capacity and policy development that may be necessary to reach full scale-up of the interventions. The Lives Saved Tool (LiST; see LiST 2015) was used to estimate the impact of interventions that target pregnant women and children. The impact of interventions that target the general population or non-pregnant women was estimated using a Microsoft Excel model. It should be noted that the LiST model does not capture potential synergies between specific interventions (e.g. the fact that the impact of behavior change communication interventions may be higher in populations that have access to affordable and diversified foods or in populations with higher levels of educational attainment). Therefore, it is possible that the impact estimates generated using LiST in fact underestimate the true impact of the interventions in some contexts.

n.a. = not applicable

Among the set of proposed interventions, vitamin A supplementation is the most cost-effective for preventing stunting, averting nearly 15,000 cases of stunting and 22,000 child deaths over 10 years. Complementary feeding education prevents nearly 40,000 cases of stunting at a cost of $284 per case averted, and total cost of $11 million over 10 years. Breastfeeding promotion through counseling mothers is projected to increase the number of infants exclusively breastfed by more than 430,000, prevent 77,000 deaths, and cost just $9.9 million over 10 years. Among the package of nutrition-specific interventions, breastfeeding promotion is the most cost-effective intervention for preventing child mortality, and costs $56 per child exclusively breastfed. For preventing maternal anemia, staple food fortification proves to be most cost-effective, at a cost of $44 for each case-year of anemia prevented in women. Over 10 years, staple food fortification will prevent nearly 940,000 cases of anemia in women at a cost of $3.7 million. Among pregnant women, antenatal micronutrient supplementation will prevent nearly 570,000 case-years of anemia at a cost of $16 per case averted, or a total of $9.1 million over 10 years.

Interventions to reduce stunting would require the most resources, accounting for about 82 percent of the total amount required for scale-up. However, some of the stunting interventions would also affect the breastfeeding and anemia targets. Figure 3.8 represents the distribution of total cost across interventions to address the four targets.

Figure 3.8: Ten-Year Financing Needs for Scaling Up a Package of Nutrition-Specific Interventionsin Benin, by Percent per Intervention



Note: Some costs for anemia, breastfeeding, and stunting are shared across interventions. Costs for breastfeeding promotion ($9.99 million) have been included in both the-total cost for the breastfeeding target and the total cost for the stunting target; the costs of intermittent presumptive treatment of malaria in pregnancy in malaria-endemic regions ($6.8 million) and antenatal micronutrient supplementation ($9.1 million) have been included in both the total cost for the anemia target and the total cost for the stunting target.

Two Alternative Investment Packages

Relative to current expenditures on health, the investment required to scale up the set of effective nutrition-specific interventions may present significant challenges for Benin. In an environment of constrained resources in which Benin may not be able to raise $309 million over the next 10 years, two alternative investment packages are laid out for consideration.

Table 3.4: Benefits and Cost-Effectiveness by Investment Package, Benin

GLOBAL TARGET	BENEFIT	PRIORITY PACKAGE	CATALYZING PROGRESS PACKAGE	FULL PACKAGE: All interventions needed to meet targets
		$8.1 million/year in financing need	**$14.6 million/year in financing need**	**$30.9 million/year in financing need**
STUNTING	Cases of stunting reduced by 2025 (vs 2015)[a]	66,000	94,000	179,000
ANEMIA	Cases of anemia in women prevented by 2025	2 million	2.4 million	3.7 million
BREASTFEEDING	Additional babies breastfed over 10 years	433,000	433,000	433,000
ALL TARGETS	**Child deaths averted over 10 years**	**20,000**	**23,000**	**29,000**
	Cost per death averted	4,072	6,361	10,465
	Cost per case of stunting averted	601	1,074	1,455

a. Total impacts of proposed intervention package combined with other health and poverty reduction efforts.

The Priority Package: The first—the "priority package"—includes interventions that are the most cost-effective; that is, have the lowest cost per health outcome (e.g., case of stunting averted), and that have well-established global policy guidelines and delivery platforms. Based on those two criteria, the priority package includes antenatal micronutrient supplementation, infant and young child nutrition counseling, intermittent presumptive treatment of malaria in pregnancy in malaria-endemic regions, vitamin A supplementation, the treatment of severe acute malnutrition, weekly iron and folic acid supplementation for girls 15–19 years of age attending school, and fortification of wheat and maize flour with iron and folic acid. These interventions would be scaled up to full program coverage in the first five years and maintained at full coverage levels for the last five years. This priority package would require an estimated $81 million over 10 years, or $8.1 million annually (see Table 3.4).

During the 10 years of scale up, this package would prevent more than 66,000 cases of stunting, prevent nearly 2 million case-years of anemia in women and would result in 433,000 children under six months of age being exclusively breastfed. It would also avert over 20,000 deaths in children under five years of age.

The Catalyzing Progress Package: The second alternative—the "catalyzing progress package"—includes scale-up of all interventions in the priority package, plus a phased approach to scaling up public provision of complementary foods, balanced energy protein supplementation, prophylactic zinc supplementation, and weekly iron and folic acid supplementation for women outside of schools. It is assumed that, for the latter set of interventions, during the first five years emphasis will be placed on establishing global guidelines and on operational research to develop effective delivery platforms, or to develop less expensive products or more cost-effective technologies. Costs are approximated as the cost of scaling up this set of interventions from 0 to 10 percent coverage only in the first five years. In the subsequent five years, it is assumed that the coverage

expansion of those interventions will accelerate and reach 60 percent by 2025. This package would require $14.6 million per year, or a total of $146 million over 10 years (Table 3.4). It would prevent more than 94,000 cases of stunting among children under age five and nearly 2.4 million case-years of anemia in women. It would also increase the number of exclusively breastfed children under six months of age by 433,000 and avert nearly 23,000 deaths.

In comparing the relative cost-effectiveness of the three investment packages, the two alternative packages are more cost-effective in preventing deaths and stunting. However, neither is as effective as the full package in making progress toward achieving the stunting, wasting, and anemia targets. The priority and catalyzing progress packages would prevent 20 ,000 and 23,000 deaths respectively, compared with 29,000 deaths prevented with the full package over 10 years. Under the full package scenario, 179,000 cases of childhood stunting would be prevented, compared with 94,000 cases under the catalyzing progress scenario and 66,000 cases under the priority package scenario. Furthermore, there would be nearly 1.7 million and 1.3 million more case-years of anemia prevented in women under the priority package and catalyzing progress package, respectively.

A Call to Action

As the world stands on the cusp of the new Sustainable Development Goals, there is an unprecedented opportunity to save children's lives, build future human capital and cognitive development, and drive faster economic growth. Scaling up key nutrition interventions during the critical 1,000 day window of early childhood would pay lifelong dividends, translating to healthier societies and more robust economies. If this window is missed, it is missed for life.

The additional financing needed to reach the global nutrition targets will require coordinated efforts by all stakeholders and a supportive policy environment. To achieve these targets, Benin will need to increase its general government health expenditure by approximately 16 percent.[5] Although this level of domestic financing is ambitious, Benin has demonstrated its commitment to improving the nutritional status of children and mothers. In the long term, nutrition interventions have significant potential to reduce poverty and boost shared prosperity.

Accelerating the reduction of stunting in Benin will be essential for maximizing the return on investments in early childhood development, in education, and more broadly in policies aimed at fostering and enhancing human capital accumulation and job creation. Investing in the early years is even more critical because the Africa region is entering a demographic transition with an expected increase in the working-age population from 54 percent in 2010 to 64 percent in 2090. The scale-up of the key nutrition-specific interventions to reduce stunting is estimated to generate considerable returns in economic benefits over the productive lives of beneficiaries, and is a necessary condition to build human capital through investments in the early years and to harness the potential benefits of the demographic dividend.

Endnotes

Note: All dollar amounts are U.S. dollars unless otherwise indicated.

[1] Information about the Power of Nutrition initiative is available at https://ciff.org/grant-portfolio/the-power-of-nutrition/.

[2] Current financing is sourced from Results for Development Institute and can be found at http://www.investinnutrition.org/.

[3] Note that because some funded interventions contribute to more than one target, the sum of funding across the four targets is less than the total funding for each target added together.

[4] Two of the global nutrition targets—those for low birthweight and for child overweight—were not included in the analyses because of insufficient data on the prevalence of low birthweight and a lack of consensus on effective interventions to reach the target for child overweight.

[5] WHO National Health Accounts database indicates general government health expenditure in Benin was US $197m in 2014. At that level, this will need to be increased by 16 percent to accommodate the $30.9 million per year required for scale-up of the interventions.

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CÔTE D'IVOIRE: *An Investment Framework for Nutrition*

Key Messages

- Thirty percent of Ivorian children under five suffer from chronic malnutrition (stunting); this rate has remained virtually unchanged over the last two decades. Children in the northern regions of the country and those in poorest households are the most affected.
- Scaling up a package of high-impact nutrition-specific interventions in Côte d'Ivoire to address global nutrition targets would require an additional $47.7 million per year over 10 years and would make an enormous health and nutrition impact (see panel on the right). These investments are over and above those needed for improving water and sanitation and for addressing issues around women's empowerment and food security.
- This scale-up would require additional financing equivalent to an 8.3 percent increase in current government health expenditures and could be financed from a combination of domestic budgets, official development assistance (ODA), and innovative financing sources such as the Power of Nutrition.[1]
- The economic benefits generated over the productive lives of beneficiaries would be massive: $8.1 billion for the prevention of stunting, $2.5 billion for breastfeeding, $1.5 billion for the prevention of anemia, and $287 million for the treatment of severe wasting.
- Returns on every dollar invested in reaching the global nutrition targets range from $9 for wasting to $24 for anemia, $27 for investing in reducing stunting, and $54 for exclusive breastfeeding.
- To finance the nutrition scale-up, two lower-cost scale-up scenarios are estimated to require between $13.5 million and $21.3 million per year over the next 10 years. In an environment of constrained resources, starting with one of these two scenarios would be a strong first investment, but it would need to be followed by increased investments to contribute toward meeting the global nutrition targets.

Benefits of Investing in Nutrition

✓ **529,000**
cases of stunting prevented in 2025

✓ **45,000**
child deaths prevented in 2025

✓ **6.5 MILLION**
case-years of anemia in women prevented in 2025

✓ **695,000**
babies exclusively breastfed

✓ **217,000**
cases of severe wasting treated

$9–$54
return for every dollar invested

$8.1 BILLION
generated from investments to reduce stunting*

**The economic benefits are calculated over the productive lives of the children benefiting from the interventions that prevent stunting.*

Investment Case for Nutrition

Ensuring optimum nutrition—particularly during the 1,000-day period from pregnancy to a child's second birthday—can alter an individual's development trajectory and maximize her or his productive potential. Chronic malnutrition has important lifelong consequences for health and cognitive development. Losses to cognitive development in early childhood resulting from chronic malnutrition are irreversible. Being stunted (low height-for-age) in early childhood is associated with a delayed start at school, reduced schooling attainment and substantially decreased adult incomes at both the individual and country level (Daniels and Adair 2004; Fink et al. 2016; Hoddinott et al. 2008; Martorell et al. 2010). These consequences add up to overall gross domestic product (GDP) losses of 4 to 11 percent in Africa and Asia (Horton and Steckel 2013). Importantly, chronic undernutrition can be transmitted through an inter-generational cycle, where malnourished mothers are more likely to have stunted children (Aguayo et al. 2016; Ozaltin et al. 2010).

Investments in nutrition are highly cost-effective and among the best value-for-money development actions (Copenhagen Consensus Center 2015; Hoddinott et al. 2013). *An Investment Framework for Nutrition*, developed by the World Bank in partnership with R4D, 1000 Days, and the Bill & Melinda Gates Foundation, estimated high returns on every dollar invested in nutrition: from $4 in returns for treating acute malnutrition (wasting) to $11 for preventing stunting, $12 for the treatment and prevention of anemia, and $35 for increasing the prevalence of exclusive breastfeeding (Shekar et al. 2017). Not only do investments in nutrition produce substantial economic benefits, but they also lay the groundwork for the success of investments in other sectors.

Investments in the early years—including early life nutrition, early learning and stimulation, and the provision of nurturing care and protection from stress—ensure that all children reach their human potential and contribute to the economic growth of their nation. The analysis presented below focuses on high-impact nutrition-specific interventions with strong evidence of efficacy in reducing malnutrition, and estimates the financing needs, impacts, and economic benefits of scaling up these interventions in Côte d'Ivoire.

Country Context

Côte d'Ivoire has a population of 22.7 million and a population growth rate of 2.4 percent (UN DESA 2015). Côte d'Ivoire has a young population, with approximately 16 percent of the country under age five (UN DESA 2015). Over 3.7 million children—or 30 percent of those under five—are affected by the largely irreversible cognitive and developmental impacts associated with stunting.

Côte d'Ivoire's economic development has been built on agriculture, but it is also emerging as an oil-rich country. Agriculture accounts for 27 percent of GDP and over three-quarters of non-oil exports, and provides income for two-thirds of all households. The labor market in Côte d'Ivoire is undergoing a transformation: the country has seen a 12 percent drop in agricultural employment between 2012 and 2015 and an increase in self and wage employment (World Bank Group 2016).

After almost two decades of strong economic growth, Côte d'Ivoire experienced a series of economic and political crises (2002–07, 2010–11) which culminated in a short war following the 2010 elections. The crises resulted in widespread deterioration of living standards. Since then, Côte d'Ivoire has experienced some of the strongest economic growth on the African continent (9 percent in 2015). Despite this growth, there has been only a marginal 0.3 percent decline in poverty for every 1 percent of economic growth since 2012. Nearly half of Ivorians continue to live in poverty—a rate that far exceeds that of 1985—as a result of successive economic shocks and political instability (World Bank Group 2016).

A large proportion of the population lives in a state of high vulnerability without any social protection. According to the 2016 UNDP *Human Development Report*, the incidence of poverty declined only marginally between 2008 and 2011, but the depth and incidence increased in a number of regions, including the North, Center North,

and North East regions. Low human capital stock remains one of the key challenges to reducing poverty and achieving greater socioeconomic equity. The Human Development Index (HDI) showed Côte d'Ivoire ranked 171st out of 187 countries, with a value of 0.474 (UNDP 2016).

Nutritional Status in Côte d'Ivoire

Persistently high rates of undernutrition remain a serious human capital challenge in Côte d'Ivoire. One in three children (29.8 percent) under five years of age are stunted (Côte d'Ivoire DHS 2011–2012). Over the past two decades, stunting prevalence has stagnated at around 30 percent and is of medium public health significance according to WHO standards. Côte d'Ivoire ranks 87th out of 130 countries assessed for highest stunting rates for children under five (IFPRI 2016). Prevalence of wasting (low weight-for-height) was 7.5 percent among children under 5 (Côte d'Ivoire DHS 2011–2012; WHO 2010) (Figure 4.1).

National estimates mask geographic and socioeconomic disparities in stunting prevalence. There continue to be significant differences in stunting prevalence among children in poorer and wealthier households, and similarly among children in rural and urban households. Stunting prevalence has remained consistently lower among children living in households in the wealthiest quintile (15.6 percent) when compared with those in poorest quintile (38.1 percent) (Figure 4.2). However, it is critical to address the key underlying drivers of malnutrition, such as high fertility rates (total fertility rate for Côte d'Ivoire is 5.0), suboptimal infant and young child nutrition practices, and hygiene and sanitation at all levels.

Figure 4.1: Trends in Undernutrition in Côte d'Ivoire, 1994–2012

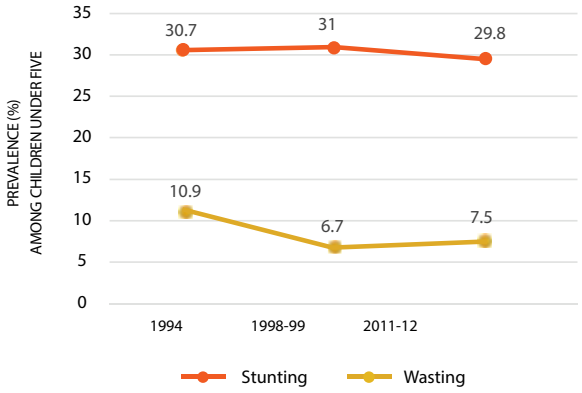
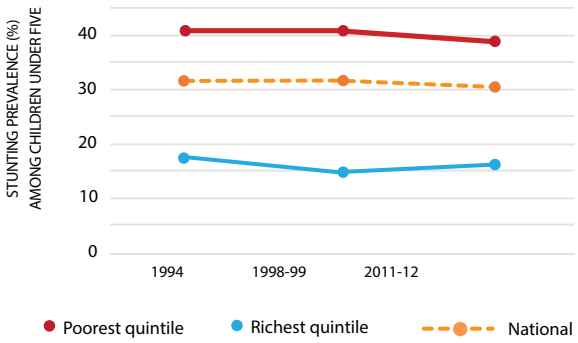


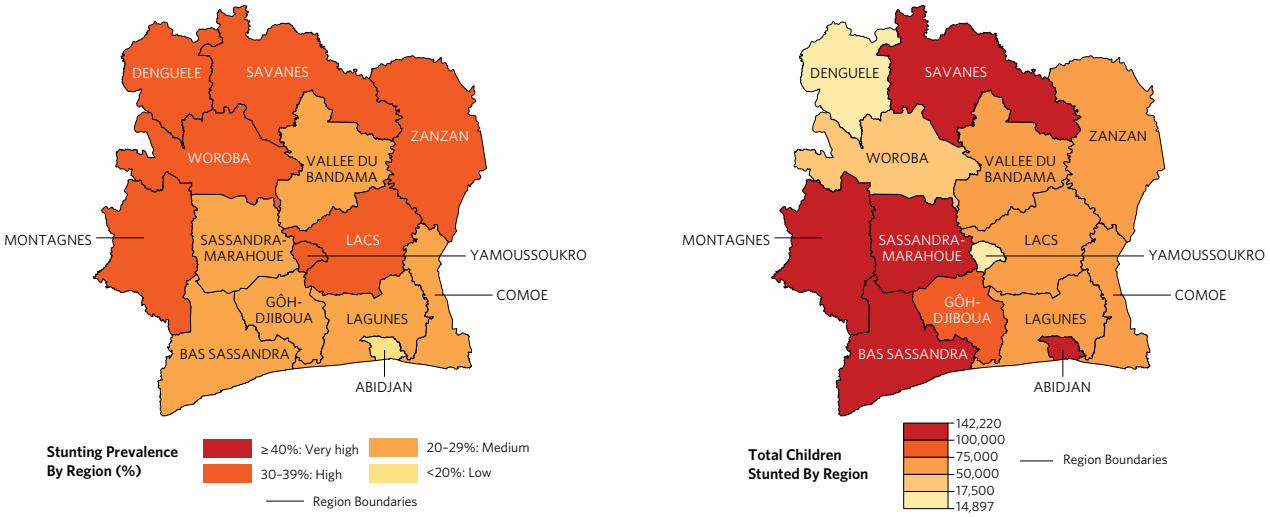
Figure 4.2: Disparities in Stunting by Wealth Quintile, 1994–2012



Source for Figures 4.1 and 4.2: Côte d'Ivoire DHS 2011–2012.

This variation is pronounced at the regional level as well. While stunting prevalence is relatively low in Abidjan (18 percent), five regions have stunting rates over 30 percent, with prevalence estimates rising to nearly 40 percent in the North and North East regions, and the highest absolute number of stunted children is concentrated in the north and southwest regions (Figure 4.3). Given the data on regional variations in stunting prevalence, it would be important to understand the key drivers of undernutrition in these highest prevalence regions and to design targeted interventions to address them.

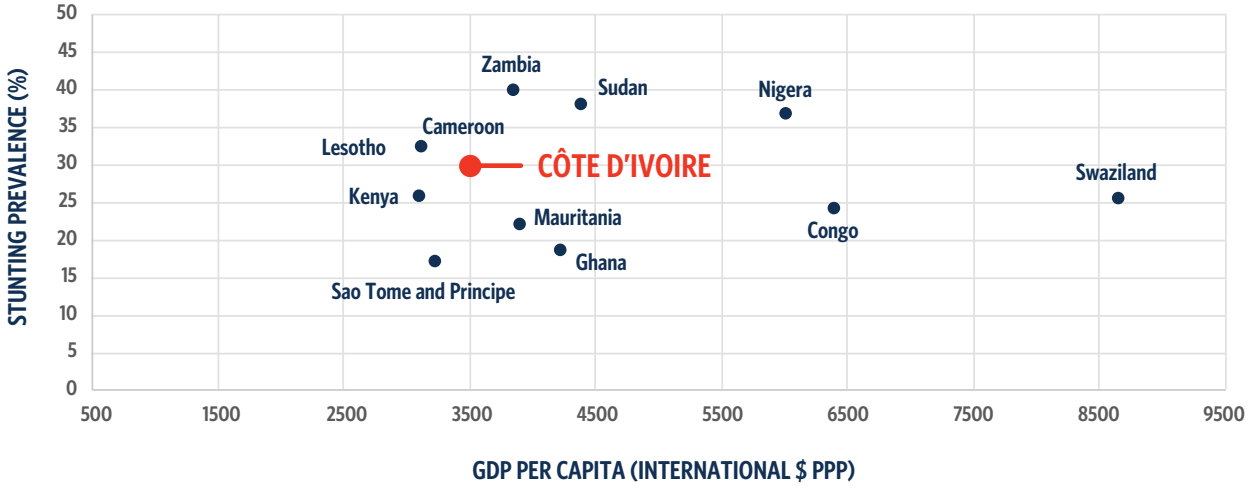
Figure 4.3: Number of Stunted Children and Stunting Prevalence by Region, Côte d'Ivoire 2011–12



Data source: Côte d'Ivoire DHS 2011–12. IBRD 42941 | MAY 2017 These maps were produced by the Cartography Unit of the World Bank Group. The boundaries, colors, denominations and any other information shown on these maps do not imply, on the part of the World Bank Group, any judgment on the legal status of any territory, or any endorsement or acceptance of such boundaries.

The prevalence of stunting in Côte d'Ivoire is lower than the average for the Africa region (35.2 percent) (World Bank 2017). Nevertheless, it is considerably higher than would be expected based on Côte d'Ivoire's per capita income level, which belies the fact that economic development needs to be coupled with other investments to attain improvements in childhood nutrition (see Figure 4.4).

Figure 4.4: Prevalence of Stunting and GDP per capita: Côte d'Ivoire and Selected Low-Middle-Income Countries



Source: UNICEF, WHO, and World Bank 2015; World Bank 2017.

Wasting, also known as acute malnutrition, is typically classified as either severe or moderate. Wasting can result from food insecurity in resource-poor settings with insufficient dietary quality, quantity and diversity, suboptimal breastfeeding, and recurrent episodes of illness such as diarrhea. Wasting prevalence across Sub-Saharan Africa is second highest in the world, after South Asia, with 13 million children (7.8 percent) suffering from acute malnutrition. Wasting in Côte d'Ivoire is just slightly below the regional prevalence at 7.5 percent.

Micronutrient deficiencies (a form of malnutrition that relates to a deficiency in essential vitamins and minerals needed for body functions and is sometimes referred to as *hidden hunger*) are highly pervasive in Côte d'Ivoire. Anemia, a condition caused by inadequate dietary intake of iron, helminth infections, and malaria, among other factors, has cross-generational impacts. More than one in two women of reproductive age in Côte d'Ivoire are anemic (Côte d'Ivoire DHS 2011–2012), which affects not only women's own health, but also contributes to the intergenerational cycle of undernutrition. Three-quarters of children aged 6 to 59 months are anemic, with three regions experiencing an anemia prevalence of over 80 percent (Côte d'Ivoire DHS 2011–2012). Ensuring that women of reproductive age are well nourished sets the stage for their children to achieve optimal nutrition and development. Recognizing that other factors beyond poverty and food insecurity put children at risk of chronic malnutrition, there is a need for effective multisectoral strategies to address undernutrition across the country.

The high prevalence of stunting in Côte d'Ivoire is associated with insufficient access to health services, poor water and sanitation, and suboptimal care and feeding practices. Demand- and supply-side barriers influence food consumption and diversity of diet. A survey conducted in 2015 found that households in rural areas spent 56 percent of their income on food, compared with 39 percent in urban areas (National Institute of Statistics 2015), thereby persistently limiting access to the range of nutrients required for growth, health, and development during the early years and beyond. Food insecurity affects 12.8 percent of the population (Ministry of Planning and Development 2015) and an estimated 20–40 percent of the population are not meeting the minimum recommended caloric intake (IMF 2009). In post-harvest and lean seasons, 72 percent of households reported food-related coping strategies including reductions in number of daily meals and consumption of non-diversified diets (Ministry of Agriculture 2016).

Political Commitment to Reduce Malnutrition

Political commitment to nutrition is very high in Côte d'Ivoire, with the Prime Minister and the Finance Minister both highly committed to the agenda. In 2013, Côte d'Ivoire joined the SUN movement, solidifying this commitment to nutrition. In 2016, a council of ministers adopted the national Multisectoral Nutrition Plan (2016–2020). This national plan identifies chronic malnutrition as a key priority for improving human and economic development in Côte d'Ivoire. The plan lays the groundwork for cross-sectoral collaboration across seven strategic areas and prioritizes the scale-up of nutrition activities in support of the Sustainable Development Goals (Ministry of Health and Public Hygiene 2016). Côte d'Ivoire has developed a common policy framework for nutrition, incorporating a common budget and results framework for both the National Nutrition Policy and the Multisectoral Nutrition Plan. The Prime Minister launched the plan in September 2016 and is mobilizing financing for its implementation.

The commitment to nutrition is also reflected in the 2016–2020 National Development Plan, which lays out targets for reducing chronic malnutrition to 20 percent and wasting to 5 percent by 2020 (Ministry of Health and Public Hygiene 2016). This commitment builds upon the 2012–2015 National Development Plan, which promoted action on food security (Côte d'Ivoire, Republic of 2012). A multisectoral Nutrition Council was established in 2014 and is chaired by the Prime Minister. The Council engages almost a dozen ministries, reflecting the multisectoral nature of food and nutrition policies and programs.

Current Financing for Nutrition

In 2015 in Côte d'Ivoire, the government and overseas donors spent a total of $4.41 million on interventions that will contribute to reaching the global targets for nutrition. Of that amount, $1.60 million came from the government and $2.82 million came from ODA. This contribution from ODA included $799,000 for stunting, $97,000 for anemia, $190,000 for breastfeeding, and $1.89 million for wasting.[2] These estimates reflect the current spending on nutrition, and the following sections detail additional financing needed in order for Côte d'Ivoire to contribute to reaching the global targets on nutrition.[3]

Global Targets for Nutrition

Substantial improvements to the nutritional status of women and children can be realized if there is adequate investment in a set of evidence-based nutrition-specific interventions that ensure optimum nutrition during the critical 1,000 day window between the start of a woman's pregnancy and the child's second birthday (Black et al. 2008, 2013). For women, these include interventions to prevent anemia before and during pregnancy as well as those aimed at improving protein energy intake and adequate antenatal care. Interventions targeted at children and their mothers aim to improve breastfeeding and complementary feeding practices, enhance the micronutrient status of children, and treat acute malnutrition in children.

In 2012—to rally the international community around improving nutrition—the 176 members of the World Health Assembly endorsed the first-ever global nutrition targets, focusing on six areas: stunting, anemia, low birthweight, childhood overweight, breastfeeding, and wasting. These targets aim to boost investments in cost-effective interventions, spearhead better implementation practices, and catalyze progress toward reducing malnutrition. The targets for stunting and wasting are enshrined within the United Nations' Sustainable Development Goal 2 (SDG 2), which commits to ending malnutrition in all its forms by the year 2030. The 2016 *Global Nutrition Report* ranked each country's progress in contributing toward achieving the global targets (Table 4.1) (IFPRI 2016).[4]

Table 4.1: Four Global Targets for Nutrition and Côte d'Ivoire's Contribution toward Meeting Them

		CÔTE D'IVOIRE RANK	PREVALENCE	PROGRESS
1 **STUNTING***	Reduce the number of stunted children under five by 40%	87/132	29.8%	🟡
2 **ANEMIA**	Reduce the number of women of reproductive age with anemia by 50%	173/185	53.7%	🔴
5 **BREASTFEEDING**	Increase the rate of exclusive breastfeeding in the first six months up to at least 50%	126/141	12.1%	🟡
6 **WASTING***	Reduce and maintain childhood wasting (acute malnutrition) to less than 5%	92/130	7.5%	🔴

LEGEND: 🔴 Off course, no progress 🟡 Off course, some progress 🟢 On course, good progress

Sources: Nutrition targets from WHO 2014; Rank and progress from IFPRI 2016; Prevalence data from Cote d'Ivoire DHS 2011-12.

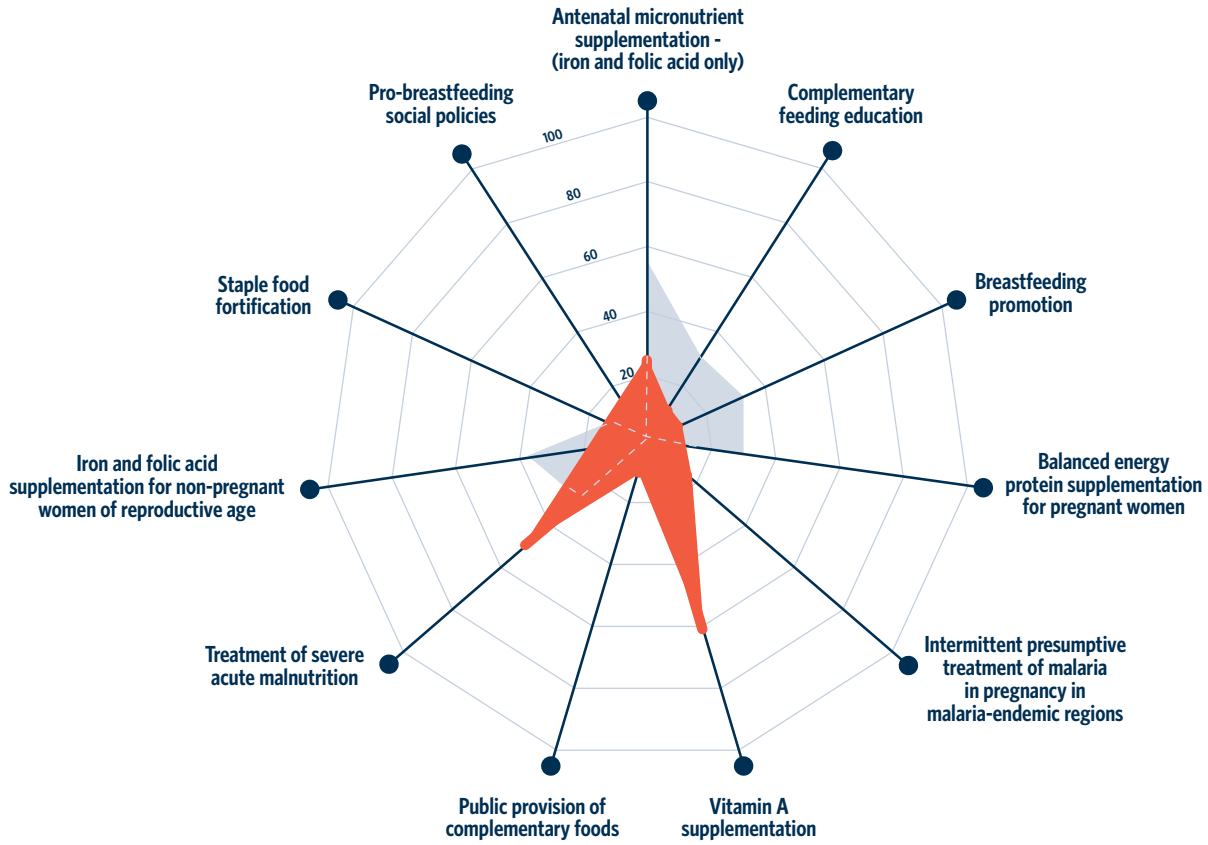
**Stunting and wasting are included within the United Nations' Sustainable Development Goal 2 (SDG 2), which commits to ending malnutrition in all its forms by the year 2030.*

Coverage of key nutrition-specific interventions in Côte d'Ivoire is largely inadequate, and is well below the levels necessary to advance progress in reducing malnutrition among Ivorian children. Table 4.2 and Figure 4.5 summarize the current coverage of and delivery platforms for nutrition-specific interventions in Côte d'Ivoire.

Table 4.2: Delivery Platforms of Nutrition-Specific Interventions in Côte d'Ivoire

INTERVENTION	PLATFORM
Antenatal micronutrient supplementation - (iron and folic acid only)	Health facility and community
Complementary feeding education	Health facility, community, and communication campaigns
Breastfeeding promotion	Health facility, community, and community campaigns
Balanced energy protein supplementation for pregnant women	Health facility, community, and social safety net programs
Intermittent presumptive treatment of malaria in pregnancy in malaria-endemic regions	Health facility and community
Vitamin A supplementation	Health facility, community, and food fortification
Public provision of complementary foods	Health facility, community, and social safety net programs
Treatment of severe acute malnutrition	Health facility and community
Iron and folic acid supplementation for non-pregnant women of reproductive age	School, community, health facility, and marketplace
Staple food fortification	Marketplace
Pro-breastfeeding social policies	Government policies
National breastfeeding promotion campaigns	Media

Figure 4.5: Coverage of Key Nutrition-Specific Interventions: Côte d'Ivoire and Sub-Saharan Africa

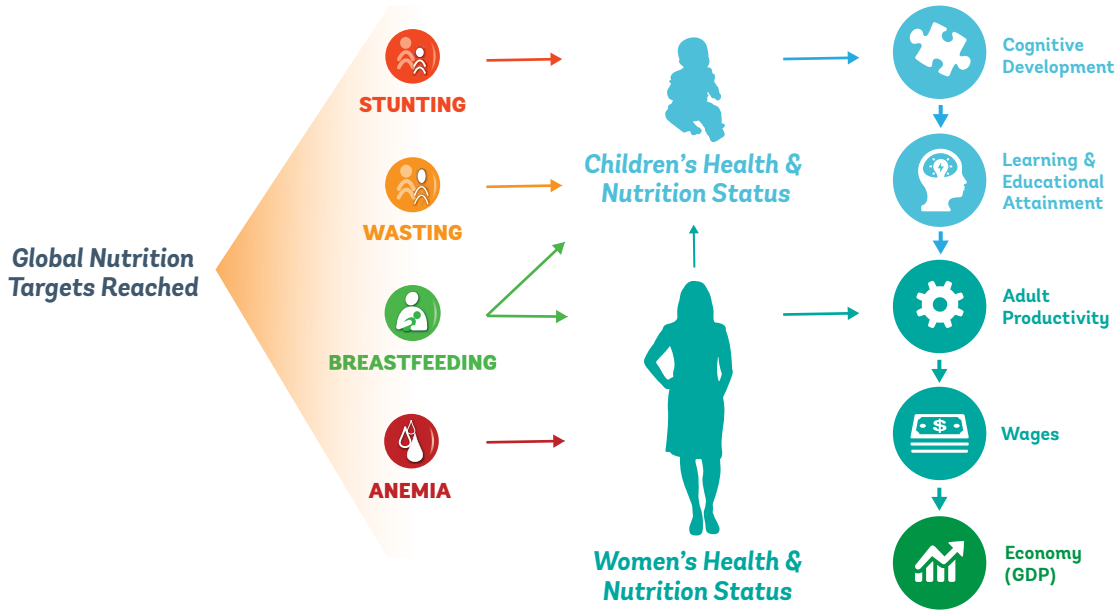


Note: Red shading represents Côte d'Ivoire and light blue shading represents average Sub-Saharan Africa coverage

Economic Benefits of Investing in Nutrition

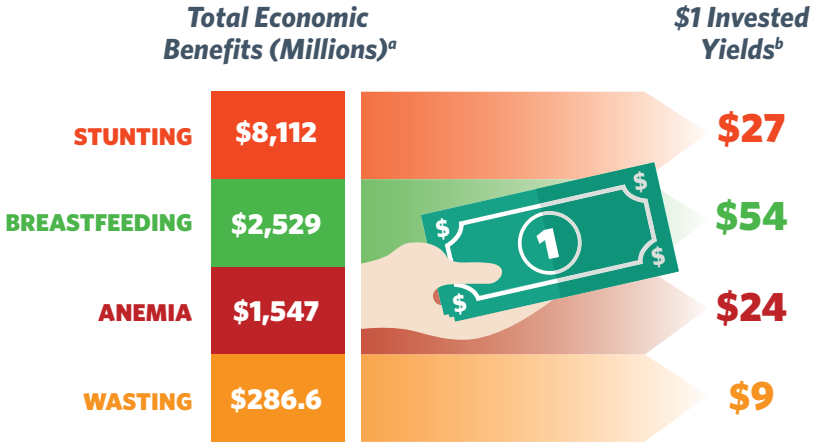
There is a strong body of evidence that shows high economic returns to investing in nutrition (Alderman et al. 2016; Copenhagen Consensus Center 2015; Hoddinott et al. 2013). Scaling up these proven nutrition-specific interventions can ensure that mothers are healthy and well nourished, that they can provide optimal nutrition to their children, that children realize their full physical and cognitive development potential, and that women's productivity is not hampered by illness, especially anemia (Figure 4.6).

Figure 4.6: How Reaching the Global Nutrition Targets Generates Economic Benefits



In Côte d'Ivoire, scaling-up the package nutrition-specific interventions would produce substantial economic benefits over the productive lifetime of the affected women and children (Figure 4.7). Additional health system cost-savings would also be likely because many of these investments reduce the burden of childhood illnesses such as diarrhea and pneumonia.

Figure 4.7: Investments in Côte d'Ivoire to Meet the Global Nutrition Targets Have Enormous Economic Returns



a. Total economic benefits over 10 years for women and over the productive lives of children who benefit from these interventions, defined as the period between the age of 18 and a "retirement" age - the life expectancy or the age of 65, whichever is lower.

b. Benefit calculation assumes a 3 percent discount rate for both financing needs and benefits and a GDP growth rate of 3 percent.

Financing Needs, Impacts, and Cost-Effectiveness of Scaling-Up Nutrition-Specific Interventions

Using the methodology detailed in *An Investment Framework for Nutrition* (Shekar et al. 2017), this brief presents estimates of the resources needed to scale up a package of 12 high-impact nutrition-specific interventions in Côte d'Ivoire to meet the global nutrition targets for stunting, anemia, breastfeeding, and wasting, along with their estimated nutrition, health, and economic impacts. An additional $47.7 million per year over 10 years is needed to scale up the package of key interventions (Table 4.3). The health and nutrition impacts of this investment are shown in Table 4.4.

Table 4.3: Estimated 10-Year Financing Needs and Cost-Effectiveness of Scaling Up Nutrition-Specific Interventions, Côte d'Ivoire

INTERVENTION (NUTRITION TARGET)	TOTAL 10-YEAR FINANCING NEEDS (US $M)	COST PER DEATH AVERTED (US $)	COST PER CASE OF STUNTING AVERTED (US $)
For pregnant women and mothers of infants			
Antenatal micronutrient supplementation (stunting, anemia)	24.7	8,395	4,173
Infant and young child nutrition counseling (complementary feeding education and breastfeeding promotion combined) (stunting, breastfeeding)	22.7	2,017	125
Complementary feeding education (stunting)	11.3	2,269	63
Breastfeeding promotion (stunting, breastfeeding)	11.5	1,820	3,302
Balanced energy protein supplementation for pregnant women (stunting)	56.7	20,551	10,647
Intermittent presumptive treatment of malaria in pregnancy (stunting, anemia)	14.6	2,294	1,087
For infants and young children			
Vitamin A supplementation (stunting)	5.3	1,630	513
Prophylactic zinc supplementation (stunting)	76.4	6,766	489
Public provision of complementary food (stunting)	181.0	66,705	1,763
Treatment of severe acute malnutrition (wasting)	39.2	10,184	n.a
For non-pregnant women and general population			
Iron and folic acid supplementation for non-pregnant women (anemia)	22.7	27,855	n.a
Staple food fortification (anemia)	8.2		n.a
Pro-breastfeeding social policies (breastfeeding)	5.0	n.a	n.a
National breastfeeding promotion campaigns (breastfeeding)	20.0	n.a	n.a
TOTAL:	**476.6**	**10,462**	**801**

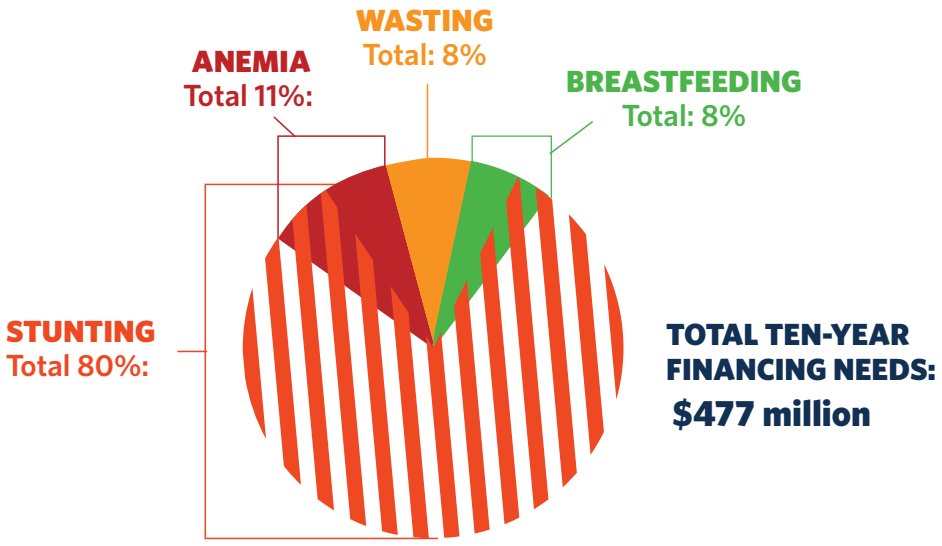
Note: Financing needs and impacts assume a linear scale-up of interventions from current coverage level to 90 percent over five years, then maintained at 90 percent for an additional five years. Unit costs for each intervention were drawn from available unit costs from neighboring countries, global costs, or estimates available in the literature. The estimated financing needs include an additional 12 percent (11 percent for pro-breastfeeding social policies and promotion campaigns) to account for monitoring, evaluation, capacity, and policy development that may be necessary to reach full scale-up of the interventions. The Lives Saved Tool (LiST; see LiST 2015) was used to estimate the impact of interventions that target pregnant women and children. The impacts of interventions that target the general population or non-pregnant women were estimated using a Microsoft Excel model. It should be noted that the LiST model does not capture potential synergies between specific interventions (e.g. the fact that the impact of behavior change communication interventions may be higher in populations that have access to affordable and diversified foods or in populations with higher levels of educational attainment). Therefore, it is possible that the impact estimates generated using LiST in fact underestimate the true impact of the interventions in some contexts.

n.a. = not applicable.

Among the set of proposed interventions, educating mothers about complementary feeding is the most effective for preventing stunting, averting more than half a million cases of stunting and 40,000 child deaths over 10 years. Breastfeeding promotion through counseling mothers is projected to increase the number of infants exclusively breastfed by 69,000, prevent over 6,000 deaths, and cost $11.5 million over 10 years. For preventing maternal anemia, staple food fortification proves to be the most cost-effective, at a cost of $5.50 for each case-year of anemia prevented in women. Over 10 years, staple food fortification will prevent nearly 1.5 million case-years of anemia in non-pregnant women at a cost of $8.2 million. Among pregnant women, antenatal micronutrient supplementation will prevent 1.5 million case-years of anemia, at a cost of $16.5 per case averted, or a total of $24.7 million over 10 years.

Interventions to reduce stunting will require the most resources, accounting for 80 percent of the total amount required for scale-up. However, some of the stunting interventions will also have impacts for the breastfeeding and anemia targets. Figure 4.8 breaks down the distribution of total financing needs across the four targets.

Figure 4.8: Ten-Year Financing Needs for Scaling Up a Package of Nutrition-Specific Interventions in Côte d'Ivoire, by Percent per Intervention



Note: Some costs for anemia, breastfeeding, and stunting are shared across interventions. Costs for breastfeeding promotion ($11.5 million) have been included in both the total cost for the breastfeeding target and the total cost for the stunting target; the costs of intermittent presumptive treatment of malaria in pregnancy in malaria-endemic regions ($14.6 million) and antenatal micronutrient supplementation ($24.7 million) have been included in both the total cost for the anemia target and the total cost for the stunting target

The analysis above includes only interventions related to the four global targets. Two additional high impact interventions aimed at improving micronutrient status, namely zinc and oral rehydration solute (ORS) for the treatment of diarrhea and deworming, will be scaled up as part of the Cote d'Ivoire's National Multisectoral Nutrition Plan. The World Bank had previously conducted analysis of the cost and impact of two of these interventions in the context of the Plan. Over a five year period, the scale-up of therapeutic zinc coverage would cost an additional $39.4 million and save 7,700 additional lives, while the scale-up of deworming would cost $1.7 million and result in an additional 6.9 million children being dewormed.

Two Alternative Investment Packages

Relative to current expenditures on health, the investment required to scale up the set of effective nutrition-specific interventions may present significant challenges for Côte d'Ivoire. In an environment of constrained resources in which Côte d'Ivoire may not be able to raise $477 million over the next 10 years, two alternative investment packages are laid out for consideration.

Table 4.4: Benefits and Cost-Effectiveness by Investment Package, Côte d'Ivoire

GLOBAL TARGET	BENEFIT	PRIORITY PACKAGE	CATALYZING PROGRESS PACKAGE	FULL PACKAGE: All interventions needed to meet targets
		$13.5 million/year in financing need	**$21.3 million/year financing need**	**$47.7 million/year in financing need**
STUNTING	Cases of stunting reduced by 2025 (vs 2015)[a]	253,000	330,000	529,000
ANEMIA	Cases of anemia in women prevented by 2025	2 million	2.6 million	6.5 million
BREASTFEEDING	Additional babies breastfed over 10 years	695,000	695,000	695,000
ALL TARGETS	**Child deaths averted over 10 years**	**34,000**	**39,000**	**45,000**
	Cost per death averted	4,019	5,458	10,463
	Cost per case of stunting averted	266	489	801

a. Total impacts of proposed intervention package combined with other health and poverty reduction efforts.

The Priority Package: The first—the "priority package"—includes interventions that are the most cost-effective; that is, have the lowest cost per health outcome (e.g., case of stunting averted), and that have well-established global policy guidelines and delivery platforms. Based on those two criteria, the priority package includes antenatal micronutrient supplementation, infant and young child nutrition counseling, intermittent presumptive treatment of malaria in pregnancy in malaria-endemic regions, vitamin A supplementation, the treatment of severe acute malnutrition, weekly iron and folic acid supplementation for girls 15–19 years of age attending school, and fortification of wheat and maize flour with iron and folic acid. These interventions would be scaled up to full program coverage in the first five years and maintained at full coverage levels for the last five years. This priority package would require an estimated $135 million over 10 years, or $13.5 million annually (see Table 4.4).

During the 10 years of scale up, this package would prevent more than 253,000 cases of stunting and avert 34,000 deaths in children under five years of age. It would also prevent nearly 2 million case-years of anemia in women and would result in 695,000 additional children under six months of age being exclusively breastfed.

The Catalyzing Progress Package: The second alternative—the "catalyzing progress package"—includes scale-up of all interventions in the priority package, plus a phased approach to scaling up public provision of complementary foods, balanced energy protein supplementation, prophylactic zinc supplementation, and weekly iron and folic acid supplementation for women outside of schools. It is assumed that, for the latter set of interventions, during the first five years, emphasis will be placed on establishing global guidelines and on operational research to develop effective delivery platforms, or to develop less expensive products or more cost-effective technologies. Costs are approximated as the cost of scaling up this set of interventions from 0 to 10 percent coverage only in the first five years. In the subsequent five years, it is assumed that the coverage expansion of those interventions will accelerate and reach 60 percent by 2025. This package would require $21.3 million per year, or a total of $213 million over 10 years (Table 4.4). It would prevent 39,000 deaths and more

than 330,000 cases of stunting among children under age five, increase the number of exclusively breastfed children under six months of age by 695,000, and prevent more than 2.6 million case-years of anemia in women.

In comparing the relative cost-effectiveness of the three intervention packages, the two alternative packages are more cost-effective in preventing deaths and stunting. However, neither is as effective as the full package in making progress toward achieving the stunting, wasting, and anemia targets. The priority and catalyzing progress packages would prevent 34,000 and 39,000 deaths respectively, compared with 45,000 deaths prevented with the full package over 10 years. Under the full package scenario, 529,000 cases of childhood stunting would be prevented, compared with 330,000 cases under the catalyzing progress scenario and 253,000 cases under the priority package scenario. Furthermore, there would be nearly 4.5 million and 3.9 million more case-years of anemia prevented in women under the priority package and catalyzing progress package, respectively.

A Call to Action

As the world stands on the cusp of the new Sustainable Development Goals, there is an unprecedented opportunity to save children's lives, build future human capital and cognitive development, and drive faster economic growth. Scaling up key nutrition interventions during the critical 1,000 day window of early childhood will pay lifelong dividends, translating to healthier societies and more robust economies. If this window is missed, it is missed for life.

The additional financing required to reach the global nutrition targets will require coordinated efforts by all stakeholders and a supportive policy environment. To achieve these targets, Côte d'Ivoire will need to increase the funding allocated to nutrition by $47.7 million annually, roughly equivalent to an 8.3 percent increase in current general government expenditure on health.[5] These investments are over and above those needed for improving water and sanitation and issues around women's empowerment, and food security. Although this level of domestic financing is ambitious, Côte d'Ivoire is already moving in this direction. In the long term, nutrition interventions have significant potential to reduce poverty and boost shared prosperity.

Accelerating the reduction of stunting in Côte d'Ivoire will be essential for maximizing the return on investments in early childhood development, in education, and more broadly in policies aimed at fostering and enhancing human capital accumulation and job creation. Investing in the early years is even more critical because the Africa region is entering a demographic transition with an expected increase in the working-age population from 54 percent in 2010 to 64 percent by 2090. The scale-up of the key nutrition-specific interventions to reduce stunting is estimated to generate considerable returns in economic benefits over the productive lives of beneficiaries, and is a necessary condition to build human capital through investments in the early years and to harness the potential benefits of the demographic dividend.

Endnotes

Note: All dollar amounts are U.S. dollars unless otherwise indicated.

[1] Information about the Power of Nutrition initiative is available at https://ciff.org/grant-portfolio/the-power-of-nutrition/.

[2] Note that because some funded interventions contribute to more than one target, total funding across the four targets is less than the total funding for each target added together.

[3] Current financing by source is from Results for Development Institute and can be found at http://www.investinnutrition.org/.

[4] Two of the global nutrition targets—those for low birthweight and for child overweight—were not included in the analyses because of insufficient data on the prevalence of low birthweight and a lack of consensus on effective interventions to reach the target for child overweight.

[5] WHO National Health accounts database indicates general government health expenditure in Cote d'Ivoire was US $575m in 2014. At that level, this will need to be increased by 8.3% to accommodate the US $47.7m per year required for scale-up of the 12 nutrition-specific interventions.

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CHAPTER 5

 ETHIOPIA: *An Investment Framework for Nutrition*

Key Messages

- Thirty-eight percent of children in Ethiopia are stunted. Those most affected live in northern regions and in the poorest households. Over the past 15 years, those in the highest wealth quintiles experienced the fastest rates of declines in stunting.
- Scaling up a package of high-impact nutrition-specific interventions in Ethiopia to address global nutrition targets would require an additional $220 million per year for 10 years and would provide enormous benefits (see panel on right). These investments are over and above those needed for improving water and sanitation, and for addressing issues around women's empowerment and food security.
- This investment would require additional financing equivalent to a 15 percent increase in current government health expenditures and could be financed from a combination of domestic budgets, official development assistance (ODA), and innovative financing sources such as the Power of Nutrition.[1]
- The economic benefits generated over the productive lives of beneficiaries would be enormous: $28 billion for stunting, $4 billion for anemia, $12 billion for breastfeeding, and $3 billion for the treatment of severe wasting.
- Returns on every dollar invested in this set of interventions range from $10 for wasting to $18 for anemia, $21 for stunting, and $66 for investing in exclusive breastfeeding.
- To finance the nutrition scale-up, two lower-cost scale-up scenarios are estimated to require between $100 and $140 million per year over the next 10 years. In an environment of constrained resources, starting with one of these two scenarios would be a strong first investment, but it would need to be followed by increased investments to contribute to meeting the global nutrition targets and the Government of Ethiopia's pledge to end child undernutrition by 2030 as laid out in the ***Segota Declaration***.

Benefits of Investing in Nutrition

✓ **1.6 MILLION**
cases of stunting prevented in 2025

✓ **130,000**
child deaths prevented in 2025

✓ **14.4 MILLION**
case-years of anemia in women prevented in 2025

✓ **1.7 MILLION**
additional babies exclusively breastfed

✓ **2.7 MILLION**
cases of severe wasting treated

$10-$66
return for every dollar invested

$28 BILLION
generated from investments to reduce stunting*

**The economic benefits are calculated over the productive lives of the children benefiting from the interventions that prevent stunting.*

Investment Case for Nutrition

Ensuring optimum nutrition—particularly during the 1,000-day period from pregnancy to a child's second birthday—can alter an individual's development trajectory and maximize her or his productive potential. Chronic malnutrition has important lifelong consequences for health and cognitive development. Losses to cognitive development in early childhood resulting from chronic malnutrition are irreversible. Being stunted (low height-for-age) in early childhood is associated with a delayed start at school, reduced schooling attainment and substantially decreased adult incomes at both the individual and country level (Daniels and Adair 2004; Fink et al. 2016; Hoddinott et al. 2008; Martorell et al. 2010). These consequences add up to overall GDP losses of 4 to 11 percent in Africa and Asia (Horton and Steckel 2013). Importantly, chronic undernutrition can be transmitted through an inter-generational cycle, where malnourished mothers are more likely to have stunted children (Aguayo et al. 2016; Ozaltin et al. 2010).

Investments in nutrition are highly cost-effective and among the best value-for-money development actions (Copenhagen Consensus Center 2015; Hoddinott et al. 2013). *An Investment Framework for Nutrition* developed by the World Bank in partnership with R4D, 1000 Days, and the Bill and Melinda Gates Foundation estimated high returns on every dollar invested in nutrition: from $4 in returns for treating acute malnutrition (wasting) to $11 for preventing stunting, $12 for the treatment and prevention of anemia, and $35 for increasing the prevalence of exclusive breastfeeding (Shekar et al. 2017). Not only do investments in nutrition produce substantial economic benefits, but they also lay the groundwork for the success of investments in other sectors.

Investments in the early years including early life nutrition, early learning and stimulation, and nurturing care and protection from stress ensure that all children reach their human potential and contribute to the economic growth of their nation. The analysis presented below focuses on high-impact nutrition-specific interventions with strong evidence of efficacy in reducing malnutrition, and estimates the costs, impact, and economic benefits of scaling up these interventions in Ethiopia.

Country Context

Ethiopia is the second-most populous country in Sub-Saharan Africa, with a population of almost 100 million and a population growth rate of 2.5 percent. Ethiopia has a young population, with approximately 15 percent of the country under age five (UN DESA 2015).

More than 80 percent of the population resides in rural areas, and agriculture accounts for 77 percent of employment in Ethiopia. Ethiopia's economy is among the fastest growing in the world, despite slowed growth in 2015–2016 due to the recent drought. The Government of Ethiopia is implementing its National Second Growth and Transformation Plan (GTP II) for the period 2015/16 – 2019/20, outlining the path for Ethiopia to become a lower-middle-income country by 2025, with a focus on sustained economic growth, job creation, promotion of women and youth empowerment, and human development (World Bank 2016).

Ethiopia has achieved substantial progress in economic, social, and human development over the past decade. Extreme poverty incidence has fallen dramatically within less than two decades (US$1.90 PPP poverty line), from 60.5 percent in 1996 to 33 percent in 2011, driven by improvements in economic growth and provision of safety nets and basic services (World Bank 2016). Additionally total fertility rate has fallen dramatically from 7.0 in the mid-1990's to the current 4.3, which is below the average for Sub-Saharan Africa (4.9). With agriculture underlying most livelihoods, the population is highly vulnerable to weather shocks and food insecurity, and malnutrition remains high (MOFED 2011).

Nutritional Status in Ethiopia

Persistently high rates of undernutrition remain a serious human development challenge in Ethiopia. More than one-in-three children (38.4 percent) under five years of age are stunted and 10 percent are wasted (low weight-for-height) (EDHS 2016). Since 2000, stunting prevalence has declined but remains of high public health significance according to WHO standards. Furthermore, Ethiopia is among the 10 countries globally with the largest numbers of children under five who suffer from acute malnutrition (wasting) (Sanchez-Montero et al. 2010). Prevalence of wasting has slowly declined, with a slight increase documented between 2014 and 2016, likely due to the recent drought (Figure 5.1).

Figure 5.1: Trends in Undernutrition in Ethiopia, 2000–2016

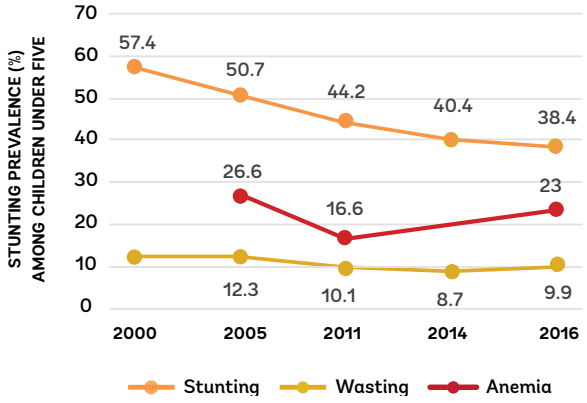
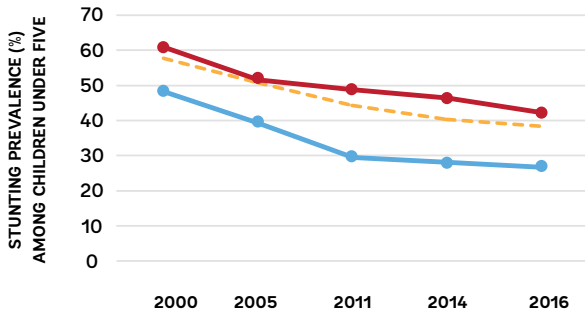


Figure 5.2: Disparities in Stunting by Wealth Quintile, 2000–2016

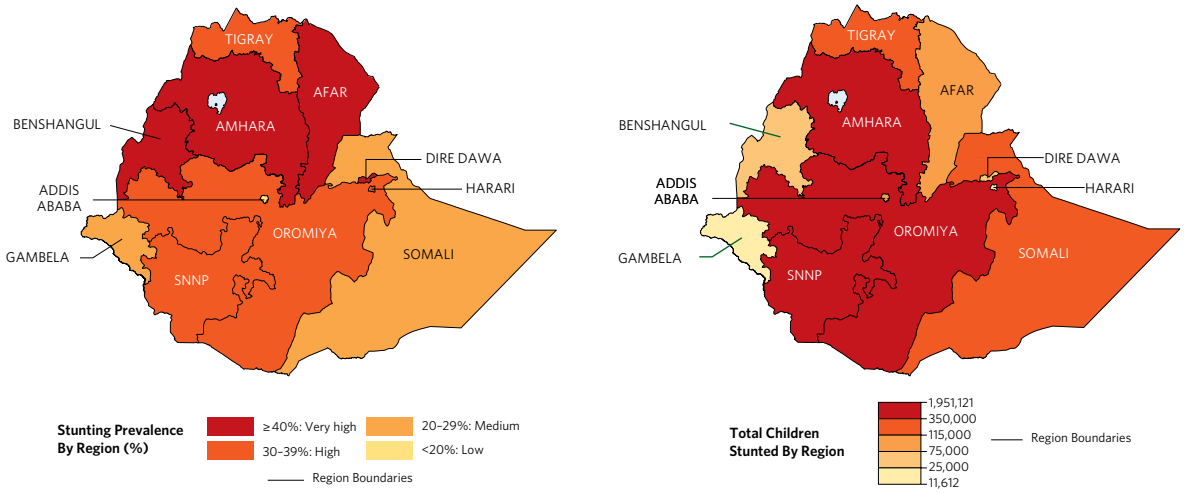


Source for Figures 5.1 and 5.2: EDHS 2016.

National estimates mask geographic and socioeconomic disparities in stunting prevalence. There continue to be significant differences in stunting prevalence among children in poorer and wealthier households. Stunting declined at a faster rate among children living in households in the top wealth quintile when compared to those in the bottom quintile (Figure 5.2). Nevertheless, even in the richest households, stunting still remains high (27 percent), underscoring the fact that rising income alone are insufficient to eliminate malnutrition.

The highest stunting prevalence rates are concentrated in the northern regions of the country, however much of the country carries a high burden in terms of absolute number of children stunted (Figure 5.3). Four regions have stunting prevalence of over 40 percent, and as many as half of children under five years of age were stunted in the Amhara region. Given the regional variations in stunting prevalence, it would be important to understand the key drivers of undernutrition in these highest prevalence regions, and to design targeted interventions to address them.

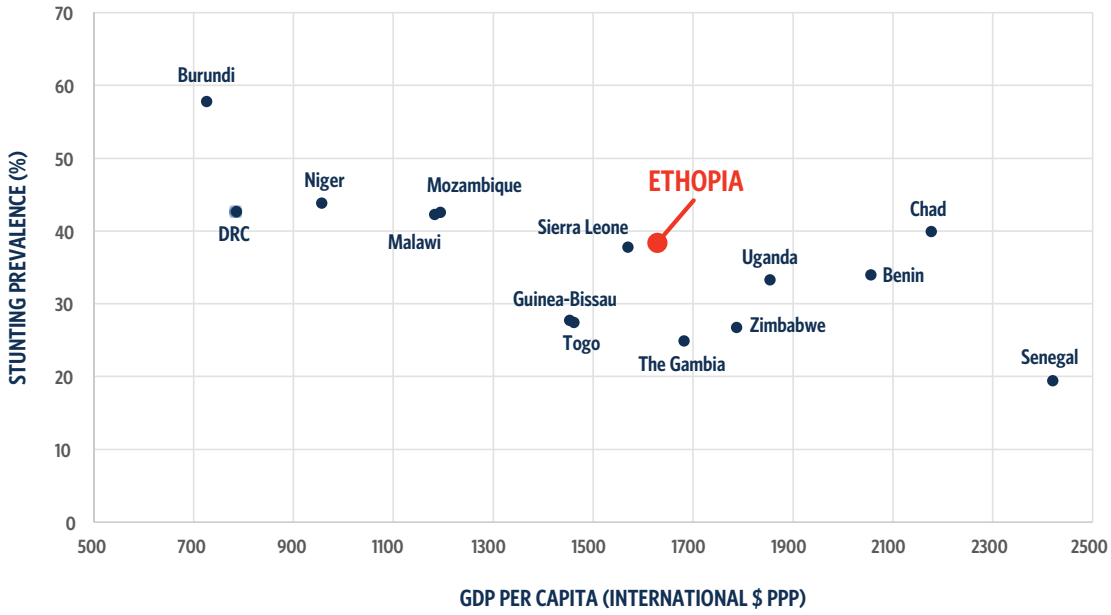
Figure 5.3: Number of Stunted Children and Stunting Prevalence by Region,



Data source: EDHS 2016. IBRD 42913 and IBRD 42912 | MAY 2017 These maps were produced by the Cartography Unit of the World Bank Group. The boundaries, colors, denominations and any other information shown on these maps do not imply, on the part of the World Bank Group, any judgment on the legal status of any territory, or any endorsement or acceptance of such boundaries.

The prevalence of stunting in Ethiopia is higher than the average for the region (35.2 percent) (World Bank 2017). It is significantly higher than in African countries with similar income levels, such as Zimbabwe and Uganda, indicating that it is possible to achieve better nutrition outcomes at this income level (Figure 5.4).

Figure 5.4: Prevalence of Stunting and GDP per capita: Ethiopia and Selected Low-Income Countries



EDHS 2016 and World Bank 2017.

Wasting, also known as acute malnutrition, is typically classified as either severe or moderate. Wasting can result from food insecurity in resource-poor settings with insufficient dietary quality, quantity and diversity, suboptimal breastfeeding, and recurrent episodes of illness such as diarrhea. Wasting prevalence across Sub-Saharan Africa is second highest in the world, after South Asia, with 13 million children (7.8 percent) suffering from acute malnutrition. Ethiopia's wasting prevalence is higher than the regional average at nearly 10 percent in 2016, and one of the highest in the world. Thus, treatment of acute malnutrition, as well as efforts to better understand and address the drivers of wasting, are evermore critical to reversing this trend.

Micronutrient deficiencies, a form of malnutrition that relates to a deficiency in essential vitamins and minerals needed for body functions, also known as *hidden hunger*, are highly pervasive in Ethiopia. Anemia, a condition caused by inadequate dietary intake of iron and parasitic infections, among other causes, has cross-generational impacts on health and the economy. Approximately one in four women of reproductive age in Ethiopia are anemic (EDHS 2016), which affects not only women's own health, but also contributes to the intergenerational cycle of undernutrition and lower productivity. More than half of children aged 6 to 59 months are anemic, with five regions having anemia prevalence of over 60 percent (EDHS 2016). Ensuring that women of reproductive age are well nourished sets the stage for their children to achieve optimal nutrition and development.

Ethiopia has made significant investments in health services over the past two decades, and has seen impressive progress in improving several health outcomes, including child mortality that has declined from 77 to 20 deaths per 1,000 live births between 2000 and 2016 (EDHS 2016). Despite these improvements, significant challenges remain. The high prevalence of stunting in Ethiopia is associated with insufficient access to health services, poor water and sanitation, and suboptimal care and feeding practices. Demand- and supply-side barriers influence food consumption and diversity of diet. A recent analysis found that the cost of a nutritionally balanced diet in Ethiopia exceeds households' incomes, limiting access to the range of nutrients required for growth, health and development during the early years and beyond (De Pee et al. 2010). Recognizing that factors other than poverty and food insecurity put children at risk of chronic malnutrition, there is a need for effective multi-sectoral strategies to address undernutrition across the country.

A recent report found that 28 percent of all child mortality and 16 percent of primary school repetitions in Ethiopia are associated with undernutrition (African Union Commission et al. 2014). Total annual costs associated with undernutrition are estimated at 16.5 percent of the Ethiopian gross domestic product (GDP) (55.5 billion Ethiopian birr) and are driven largely by lost working hours due to mortality associated with undernutrition and lower productivity of adults engaged in manual labor, such as agricultural work (Government of Ethiopia 2013).

Political Commitment to Reduce Malnutrition

In 2015, the Government of Ethiopia, a member of the SUN movement since 2011, adopted the Seqota Declaration to end child undernutrition by 2030 (Denys 2015). This declaration identifies nutrition targets and implementation guidelines, and mobilizes ministries across sectors to address the underlying causes of malnutrition, with a focus on improved agriculture, food quality and micronutrient fortification. The commitment to nutrition is also reflected in the inclusion of an indicator to measure stunting in the five-year National Growth and Transformation Plan (GTP II 2016-2020) (Government of Ethiopia 2015).

The Government of Ethiopia enacted the National Nutrition Plan (NNP I 2008-2015) to reorient the nutrition focus in the country from humanitarian emergencies to a more systematic and strategic preventive/promotive approach. Building on the success of this initiative, in 2016 the government launched the NNP II (2016-2020) with a focus on multi-sectoral actions to improve nutrition outcomes, particularly within the first 1,000 days, including through agriculture, water, education, social protection, and health sector as well as a nutrition coordination structure that extends from sub-woreda level to regional levels.

Current Financing for Nutrition

In 2015 in Ethiopia, the government and foreign donors spent a total of $71.8 million on interventions that contribute to reaching the global targets for nutrition. Of that amount, $2.55 million came from the government and $69.2 million came from ODA. This contribution from ODA included $23 million for stunting, $4.76 million for anemia, $7.26 million for breastfeeding, and $38.2 million for wasting.[2] These estimates reflect the current spending on nutrition; the following sections detail additional financing needed in order for Ethiopia to contribute to reaching the global targets on nutrition.[3]

Global Targets for Nutrition

Substantial improvements to the nutritional status of women and children can be realized if there is adequate investment in a set of evidence-based nutrition-specific interventions that ensure optimum nutrition during the critical 1,000 day window between the start of a woman's pregnancy and the child's second birthday (Black et al. 2008, 2013). For women, these include interventions to prevent anemia before and during pregnancy, as well as those aimed at improving protein energy intake during pregnancy. Interventions targeted at children and their mothers aim to improve breastfeeding and complementary feeding practices, micronutrient status of children, and to treat acute malnutrition in children.

In 2012—to rally the international community around improving nutrition—the 176 members of the World Health Assembly endorsed the first-ever global nutrition targets, focusing on six areas: stunting, anemia, low birthweight, childhood overweight, breastfeeding, and wasting. These targets aim to boost investments in cost-effective interventions, spearhead better implementation practices, and catalyze progress toward reducing malnutrition. The targets for stunting and wasting are enshrined within the United Nations' Sustainable Development Goal 2 (SDG 2), which commits to ending malnutrition in all its forms by the year 2030. The 2016 *Global Nutrition Report* ranked each country's progress in contributing toward achieving the global targets (Table 5.1) (IFPRI 2016)[4].

Table 5.1: Four Global Targets for Nutrition and Ethiopia's Contribution Toward Meeting Them

		ETHIOPIA'S RANK	PREVALENCE	PROGRESS
1 STUNTING*	Reduce the number of stunted children under five by 40%	117/132	38%	●
2 ANEMIA	Reduce the number of women of reproductive age with anemia by 50%	37/185	23%	●
5 BREASTFEEDING	Increase the rate of exclusive breastfeeding in the first six months up to at least 50%	38/141	58%	●
6 WASTING*	Reduce and maintain childhood wasting (acute malnutrition) to less than 5%	98/130	10%	●

LEGEND: ● Off course, no progress ● Off course, some progress ● On course, good progress

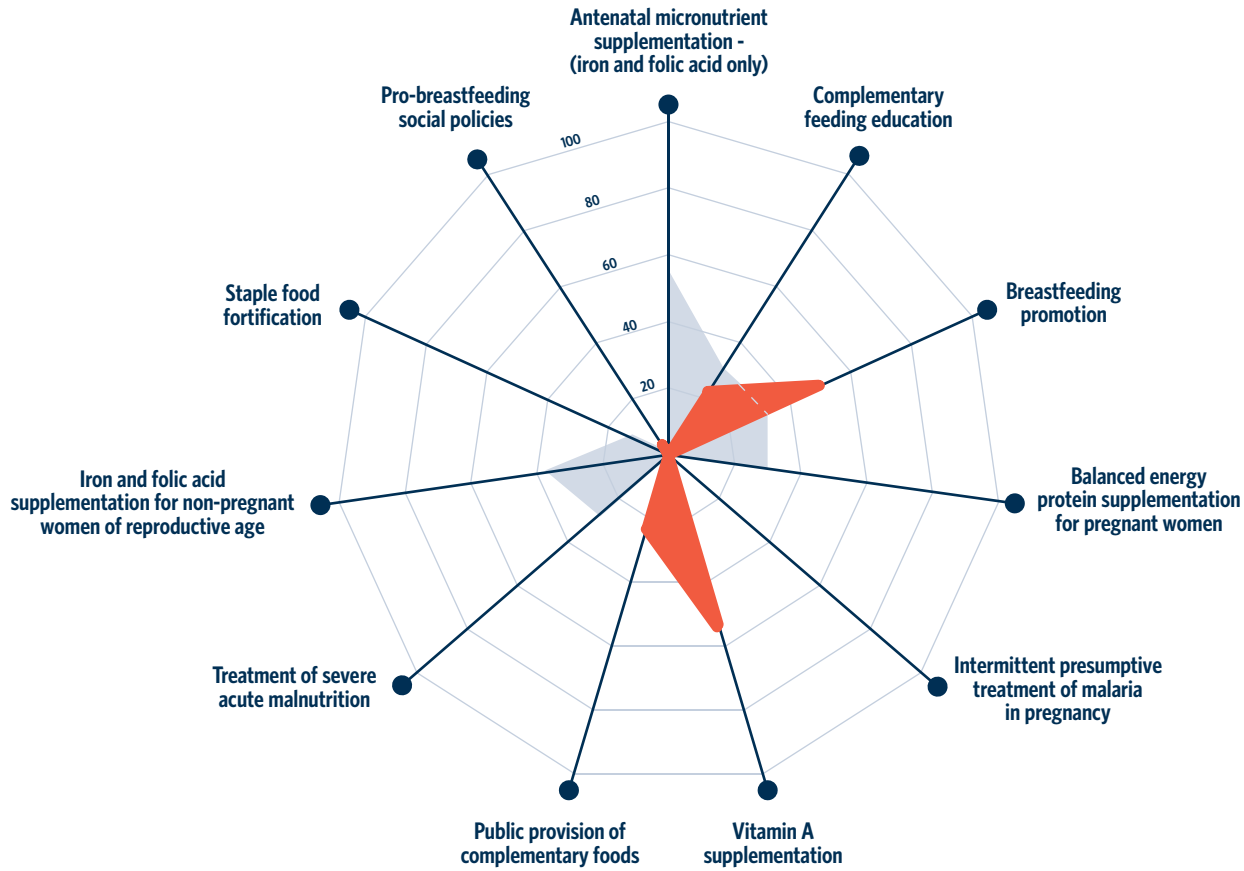
**Stunting and wasting are included within the United Nations' Sustainable Development Goal 2 (SDG 2), which commits to ending malnutrition in all its forms by the year 2030. Sources: Nutrition targets from WHO 2014; Rank and progress from IFPRI 2016; Prevalence data from EDHS 2016.*

Coverage of key nutrition-specific interventions in Ethiopia is largely inadequate. Although coverage rates are higher for some childhood interventions, they remain well below the levels necessary to advance progress in reducing malnutrition among Ethiopian children. Table 5.2 and Figure 5.5 summarize the current coverage of and delivery platforms available for nutrition-specific interventions in Ethiopia.

Table 5.2: Delivery Platforms For Nutrition-Specific Interventions In Ethiopia

INTERVENTION	DELIVERY PLATFORM
Antenatal micronutrient supplementation (iron and folic acid only)	Health facility and community
Complementary feeding education	Health facility, community, and communication campaigns
Breastfeeding promotion	Health facility, community, and communication campaigns
Balanced energy protein supplementation for pregnant women	Health facility, community, and social safety net programs
Intermittent presumptive treatment of malaria in pregnancy	Health facility, community, and food fortification
Vitamin A supplementation	Health facility, community, and food fortification
Public provision of complementary foods	Health facility, community, and social safety net programs
Treatment of severe acute malnutrition	Health facility and community
Iron and folic acid supplementation for non-pregnant women of reproductive age	School, community, health facility, and marketplace
Staple food fortification	Marketplace
Pro-breastfeeding social policies	Government policies
National breastfeeding promotion campaigns	Media

Figure 5.5: Coverage of Key Nutrition-Specific Interventions in Ethiopia and Sub-Saharan Africa

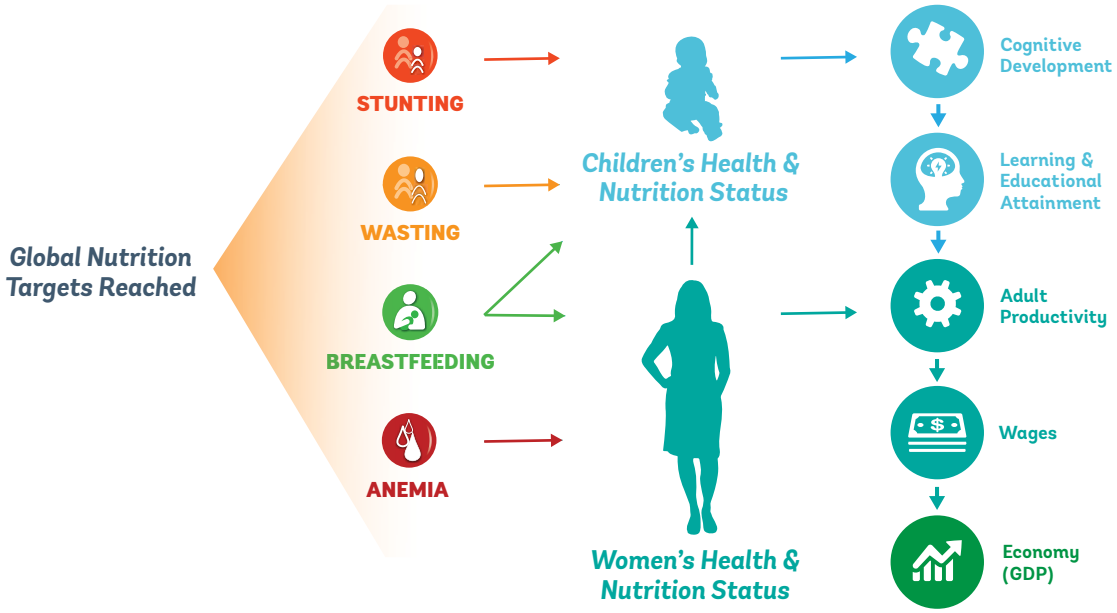


Note: Red shading represents Ethiopia and light blue shading represents average Sub-Saharan Africa coverage

Economic Benefits of Investing in Nutrition

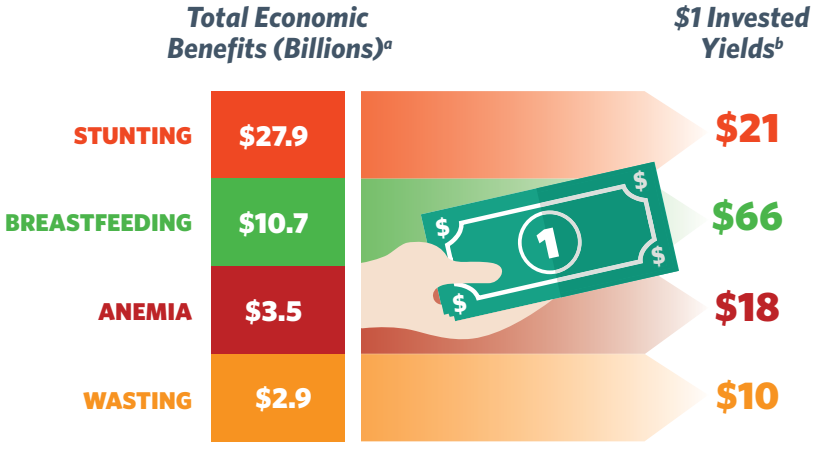
There is a strong body of evidence that shows high economic returns to investing in nutrition (Alderman et al. 2016; Copenhagen Consensus Center 2015; Hoddinott et al. 2013). Scaling up these proven nutrition-specific interventions can ensure that mothers are healthy and well-nourished and that they can provide optimal nutrition to their children, that children realize their full physical and cognitive development potential, and that women's productivity is not hampered by illness, especially anemia (Figure 5.6).

Figure 5.6: How Reaching The Global Nutrition Targets Generates Economic Benefits



In Ethiopia, scaling-up the package nutrition-specific interventions will produce substantial economic benefits over the productive lifetime of the affecte d women and children (Figure 5.7). Additional health system cost-savings are also likely because many of these investments reduce the burden of childhood illnesses such as diarrhea and pneumonia.

Figure 5.7: Investments in Ethiopia to Meet the Global Nutrition Targets Have Enormous Economic Returns



a. Total economic benefits over 10 years for women and over the productive lives of children who benefit from these interventions , defined as the period between the age of 18 and a "retirement" age - the life expectancy or the age of 65, whichever is lower.

b. Benefit calculation assumes a 3 percent discount rate for both costs and benefits, and GDP growth rate of 3 percent.

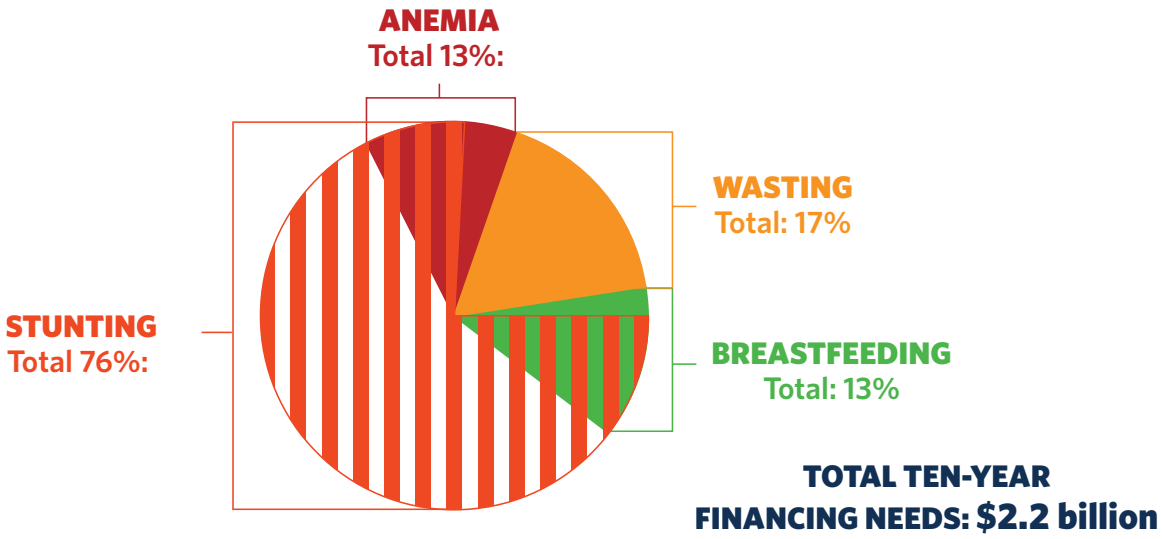
Financing Needs, Impact, and Cost-Effectiveness of Scaling Up Nutrition-Specific Interventions

Using the methodology detailed in *An Investment Framework for Nutrition* this brief presents estimates of the resources needed to scale up a package of 12 high-impact nutrition-specific interventions in Ethiopia to meet the global nutrition targets for stunting, anemia, breastfeeding and wasting, and the estimated nutrition, health and economic impact. An additional $220 million per year over 10 years is needed to scale up the package of key interventions (Table 5.3). The health and nutrition impact of this investment is shown in Table 5.4.

Among the set of proposed interventions, educating mothers about complementary feeding is the most effective for stunting, averting more than half million cases of stunting and 12,000 child deaths over 10 years. Breastfeeding promotion through counseling of mothers is projected to increase the number of infants exclusively breastfed by 1.65 million, prevent nearly 30,000 deaths, and cost $93 million over 10 years. Among these interventions, this is the most cost-effective intervention for preventing child mortality, and costs $56 per child exclusively breastfed. For preventing maternal anemia, staple food fortification proves to be most cost-effective, at a cost of $3.70 for each case of anemia prevented in women. Over 10 years, staple food fortification will prevent 4.19 million cases of anemia in women at a cost of $15.4 million.

Interventions to reduce stunting will require the most resources, accounting for about 76 percent of the total amount required for scale-up. However, some of the stunting interventions will also have impacts for achieving the targets for breastfeeding and anemia. Figure 5.8 represents the distribution of total cost across interventions to address the four targets.

Figure 5.8: Ten Year Financing Needs For Scaling Up a Package of Nutrition-Specific Interventions in Ethiopia



Note: Some costs for anemia, breastfeeding, and stunting are shared across interventions. Costs for breastfeeding promotion (US $93 million) has been included in both the total cost for the breastfeeding target and the total cost for the stunting target; cost of intermittent presumptive treatment of malaria in pregnancy (US $62.2 million) and antenatal micronutrient supplementation (US $110.7 million) have been included in both the total cost for the anemia target and the total cost for the stunting target.

Table 5.3: Estimated 10-Year Financing Needs and Cost-Effectiveness of Scaling Up Nutrition-Specific Interventions, Ethiopia

INTERVENTION (NUTRITION TARGET)	TOTAL 10-YEAR FINANCING NEEDS (US $M)	COST PER DEATH AVERTED (US $)	COST PER CASE OF STUNTING AVERTED (US $)
For pregnant women and mothers of infants			
Antenatal micronutrient supplementation (stunting, anemia)	110.7	10,491	8,170
Infant and young child nutrition counseling (complementary feeding education and breastfeeding promotion combined) (stunting, breastfeeding)	235.1	5,865	411
Complementary feeding education	142.1	11,517	254
Breastfeeding promotion	93.0	3,352	7,671
Balanced energy protein supplementation for pregnant women (stunting)	210.0	28,256	45,537
Intermittent presumptive treatment of malaria in pregnancy (anemia)	62.2	4,230	1,965
For infants and young children			
Vitamin A supplementation (stunting)	48.5	7,188	384
Prophylactic zinc supplementation (stunting)	541.4	33,852	1,062
Public provision of complementary food (stunting)	453.6	57,743	1,317
Treatment of severe acute malnutrition (wasting)	366.7	11,744	n/a
For non-pregnant women and general population			
Iron and folic acid supplementation for non-pregnant women (anemia)	90.5	15,252	n/a
Staple food fortification (anemia)	15.4		n/a
Pro-breastfeeding social policies (breastfeeding)	6.2	n/a	n/a
National breastfeeding promotion campaigns (breastfeeding)	33.3	n/a	n/a
TOTAL:	**2,173.7**	**15,078**	**1,037**

Note: Financing needs and impacts assume a linear scale-up of interventions from current coverage level to 90 percent over five years, then maintained at 90 percent for an additional five years. Unit costs for each intervention were drawn from available unit costs from neighboring countries, global costs, or estimates available in the literature. The estimated financing needs include an additional 12 percent (11 percent for pro-breastfeeding social policies and promotion campaigns) to account for monitoring, evaluation, capacity and policy development that may be necessary to reach full scale-up of the interventions. The Lives Saved Tool (LiST) was used to estimate the impact of interventions that target pregnant women and children. The impact of interventions that target the general population or non-pregnant women were estimated using a Microsoft Excel model. It should be noted that the LiST model does not capture potential synergies between specific interventions (e.g. the fact that the impact of behavior change communication interventions may be higher in populations that have access to affordable and diversified foods or in populations with higher levels of educational attainment). Therefore, it is possible that the impact estimates generated using LiST in fact underestimate the true impact of the interventions in some contexts.

n.a. = not applicable.

Two Alternative Investment Packages

In an environment of constrained resources in which Ethiopia may not be able to raise $220 over the next 10 years, two alternative investment packages are laid out for consideration.

The Priority Package: The first—the "priority package"—includes interventions that are the most cost- effective, that is, have the lowest cost per health outcome (e.g., case of stunting averted), and that have well-established global policy guidelines and delivery platforms. Based on those two criteria, the priority package includes:antenatal micronutrient supplementation, infant and young child nutrition counseling, intermittent presumptive treatment of malaria in pregnancy in malaria-endemic regions;vitamin A supplementation; treatment of severe acute malnutrition intermittent weekly iron and folic acid supplementation for girls 15–19 years of age attending school; and) fortification of wheat and maize flour with iron and folic acid. These

Table 5.4: Benefits and Cost-Effectiveness By Investment Package, Ethiopia

GLOBAL TARGET	BENEFIT	PRIORITY PACKAGE	CATALYZING PROGRESS PACKAGE	FULL PACKAGE: All interventions needed to meet targets
		$99 million/year in financing need	**$138 million/year financing need**	**$220 million/year in financing need**
STUNTING	Cases of stunting reduced by 2025 (vs 2015)[a]	0.7 million	1.0 million	1.6 million
ANEMIA	Cases of anemia in women prevented by 2025	2.7 million	10.0 million	14.4 million
BREASTFEEDING	Additional babies breastfed over 10 years	1.7 million	1.7 million	1.7 million
ALL TARGETS	**Child deaths averted over 10 years**	**97,000**	**107,000**	**130,000**
	Cost per death averted	10,247	12,897	16.692
	Cost per case of stunting averted	630	840	1,038

a. Total impact of proposed intervention package combined with other health and poverty reduction efforts.

interventions would be scaled up to full program coverage in the first five years and maintained at full coverage levels for the last five years. This priority package would require an estimated $994 million over 10 years, or $99.4 million annually (see Table 5.4).

During the 10 years of scale-up, this package would prevent 700,000 cases of stunting and avert 97,000 deaths in children under five years of age. It would also prevent 2.7 million case-years of anemia in women and would result in 1.7 million additional children under 6 months of age being exclusively breastfed.

The Catalyzing Progress Package: The second alternative—"catalyzing progress"—includes scale-up of all interventions in the priority package, plus a phased approach to scaling up public provision of complementary foods, balanced energy protein supplementation, prophylactic zinc supplementation, and weekly iron-folic acid supplementation for women outside of schools. It is assumed that, for the latter set of interventions, during the first five years, emphasis will be placed on establishing global guidelines and on operational research to develop effective delivery platforms, or to develop less expensive products or more cost-effective technologies. Costs are approximated as the cost of scaling up this set of interventions from 0 to 10 percent coverage only in the first five years. In the subsequent five years, it is assumed that the coverage expansion of those interventions will accelerate and reach 60 percent by 2025. This package would require $138 million per year, a total of $1.38 billion over 10 years (Table 5.4). It would prevent 107,000 deaths and 1 million cases of stunting among children under five, increase the number of exclusively breastfed children under six months of age by 1.7 million, and prevent 10 million case-years of anemia in women.

In comparing the relative cost-effectiveness of the three investment packages, the two alternative packages are more cost-effective in preventing deaths and stunting. However, neither is as effective as the full package in making progress toward achieving the stunting, wasting, and anemia targets. The priority and catalyzing

progress packages will prevent 97,000 and 107,000 thousand deaths respectively, compared with 130,000 deaths prevented with the full package over 10 years. Under the full package scenario, 1.6 million cases of childhood stunting will be prevented, compared with 1 million cases under the catalyzing progress scenario and 700,000 cases under the priority package scenario. Furthermore, there would be nearly 11.7 million and 4.4 million more cases of anemia in women under the priority package and catalyzing progress package, respectively.

A Call to Action

As the world stands at the cusp of the new Sustainable Development Goals, there is an unprecedented opportunity to save children's lives, build future human capital and cognitive development, and drive faster economic growth. Scaling-up key nutrition interventions during the critical 1,000 day window of early childhood will pay lifelong dividends, translating to healthier societies and more robust economies. If this window is missed, it is missed for life.

The additional financing required to reach the global nutrition targets will require coordinated efforts by all stakeholders and a supportive policy environment. To achieve these targets would require an increase in the funding allocated to nutrition by $220 million annually, roughly an equivalent to a 15 percent increase in current general government expenditure on health.[5] These investments are over and above those needed for improving water and sanitation, and issues around women's empowerment, and food security. Although this level of domestic financing is ambitious, Ethiopia is already moving in this direction. In the long term, nutrition interventions have significant potential to reduce poverty and boost shared prosperity.

Accelerating the reduction of stunting in Ethiopia will be essential for maximizing the return on investments in early childhood development, in education, and more broadly in policies aimed at fostering and enhancing human capital accumulation and job creation. Investing in the early years is even more critical because the Africa region is entering a demographic transition with an expected increase in the working age population from 54 percent in 2010 to 64 percent in 2090. The scale-up of the key nutrition-specific interventions to reduce stunting is estimated to generate considerable returns in economic benefits over the productive lives of beneficiaries, and is a necessary condition to build human capital through investments in the early years and to harness the potential benefits of the demographic dividend.

Endnotes

[1] Information about the Power of Nutrition initiative is available at https://ciff.org/grant-portfolio/the-power-of-nutrition/.

[2] Note that because some funded interventions contribute to more than one target, total funding across the four targets is less than the total funding for each target added together.

[3] Current financing by source is from Results for Development Institute and can be found at http:/www.investinnutrition.org/.

[4] Two of the global nutrition targets—those for low birthweight and for child overweight—were not included in the analyses because of insufficient data on the prevalence of low birthweight and a lack of consensus on effective interventions to reach the target for child overweight.

[5] WHO National Health accounts database indicates general government health expenditure in Ethiopia was US$1,517 million in 2014. At that level, this will need to be increased by 15 percent to accommodate the US$220 million per year required for scale-up of the 12 nutrition-specific interventions.

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NIGER: *An Investment Framework for Nutrition*

Key Messages

- More than 40 percent of children in Niger are chronically malnourished (stunted), with the highest prevalences in Diffa, Zinder, and Maradi regions. In addition, nearly half (46 percent) of women of reproductive age in Niger are anemic.
- To address persistent malnutrition, the Nigerien government launched an initiative called the 3N Program, Nigeriens Nourish Nigeriens, to promote sustainable national food security and agricultural development.
- Scaling up a package of high-impact nutrition-specific interventions in Niger to contribute to reaching the global nutrition targets would require an additional $77.1 million per year over 10 years and would provide enormous benefits (see panel on right). These investments are over and above those needed for improving water and sanitation and for addressing issues around women's empowerment and food security.
- This investment would require additional financing equivalent to 40 percent of the general government expenditure on health and could be financed from a combination of domestic budgets, official development assistance (ODA), and innovative financing sources such as the Power of Nutrition.[1]
- The economic benefits generated over the productive lives of beneficiaries would be enormous: $4.1 billion for stunting, $512 million for anemia, $3 billion for breastfeeding, and $1.5 billion for the treatment of severe wasting.
- Returns on every dollar invested in reaching the global nutrition targets range from $7 in returns for anemia to $10 for stunting, $11 for wasting, and $48 for investing in exclusive breastfeeding.
- To finance the nutrition scale-up, two lower-cost scale-up scenarios are estimated to require between $29.7 and $46.6 million per year over the next 10 years. In an environment of constrained resources in Niger, starting with one of these two scenarios would be a strong first investment, but it would need to be followed by increased investments, along with investments in strengthening the national platforms for service delivery, to contribute to meeting the global nutrition targets.

Benefits of Investing in Nutrition

✓ **436,000**
cases of stunting prevented in 2025

✓ **86,000**
child deaths prevented in 2025

✓ **7.5 MILLION**
case-years of anemia in women prevented in 2025

✓ **1.2 MILLION**
babies exclusively breastfed

✓ **1.4 MILLION**
cases of severe wasting treated

$7–$48
return for every dollar invested

$4.1 BILLION
generated from investments to reduce stunting*

**The economic benefits are calculated over the productive lives of the children benefiting from the interventions that prevent stunting.*

Investment Case for Nutrition

Ensuring optimum nutrition—particularly during the 1,000-day period from pregnancy to a child's second birthday—can alter an individual's development trajectory and maximize her or his productive potential. Chronic malnutrition has important lifelong consequences for health and cognitive development. Losses to cognitive development in early childhood resulting from chronic malnutrition are irreversible. Being stunted (low height-for-age) in early childhood is associated with a delayed start at school, reduced schooling attainment, and substantially decreased adult incomes at both the individual and country level (Daniels and Adair 2004; Fink et al. 2016; Hoddinott et al. 2008; Martorell et al. 2010). These consequences add up to overall GDP losses of 4 to 11 percent in Africa and Asia (Horton and Steckel 2013). Importantly, chronic undernutrition can be transmitted through an inter-generational cycle, where malnourished mothers are more likely to have stunted children (Aguayo et al. 2016; Ozaltin et al. 2010).

Investments in nutrition are highly cost-effective and among the best value-for-money development actions (Copenhagen Consensus Center 2015; Hoddinott et al. 2013). *An Investment Framework for Nutrition* developed by the World Bank in partnership with R4D, 1000 Days, and the Bill & Melinda Gates Foundation estimated high returns on every dollar invested in nutrition: from $4 in returns for treating acute malnutrition (wasting) to $11 for preventing stunting, $12 for the treatment and prevention of anemia, and $35 for increasing the prevalence of exclusive breastfeeding (Shekar et al. 2017). Not only do investments in nutrition produce substantial economic benefits, but they also lay the groundwork for the success of investments in other sectors.

Investments in the early years—including early life nutrition, early learning and stimulation, and nurturing care and protection from stress—ensure that all children reach their human potential and contribute to the economic growth of their nation. The analysis presented below focuses on high-impact nutrition-specific interventions with strong evidence of efficacy in reducing stunting, and it estimates the costs, impact, and economic benefits of scaling up these interventions in Niger.

Country Context

The Republic of Niger is a landlocked country in Sub-Saharan Africa with a population of nearly 20 million people. Niger has one of the lowest GDP rates per capita on the continent, coupled with one of the highest population growth rates globally (4 percent) (UN DESA 2015). The absolute number of individuals living in poverty in Niger continues to increase because of the country's high population growth rate, which is highest among the poorest households (World Bank 2014). Niger's population is young—approximately 20 percent of the country are under age five (UN DESA 2015). Low human capital remains one of the key challenges in reducing poverty and achieving greater socioeconomic equity.

Over 80 percent of the population reside in rural areas (World Bank 2016). Only 4 percent of the country is arable, yet the agriculture sector represents the country's primary source of economic activity, contributing an average of 25 percent of the national GDP (Geesing and Djibo 2001; World Bank 2013). Between 2005 and 2011, income disparities between rural and urban households grew as poverty rates fell more rapidly in urban centers than in rural areas, as measured by household consumption and living conditions (World Bank 2014). During this same time period, the poverty headcount for the poorest populations decreased by four percentage points, reflecting the fact that farming households are highly sensitive to fluctuations in agricultural outputs (World Bank 2014).

The Human Development Index (HDI) showed Niger ranked 187 out of 188 countries in 2016, with a value of 0.353 (UNDP 2016), exacerbating vulnerability and compounding a poor household's ability to meet basic needs. Child malnutrition, an underlying cause of up to 45 percent of deaths of children under age five (Black et al. 2013), has emerged as one of the key markers of poverty and vulnerability as well as one of the key challenges to ensuring optimal accumulation of human capital in the country.

Nutritional Status in Niger

Persistently high rates of undernutrition remain a serious human development challenge in Niger. More than 40 percent of children under age five are stunted and 18 percent are wasted (low weight-for-height) (NDHS 2012). Between 1992 and 2006, stunting prevalence increased, but this was followed by a decline from 54.8 percent in 2006 to 43.9 percent in 2012 (NDHS 2006). Despite this recent downward trend, Niger still ranks 122nd out of 132 countries assessed for highest stunting prevalence in children under age five (IFPRI 2016). At the same time, wasting prevalence increased sharply, from 12.4 percent in 2006 to 18 percent in 2012 (Figure 6.1) (NDHS 2006, 2012) suggesting that acute forms of malnutrition are on the rise.

Although levels of chronic malnutrition show some socioeconomic variation, stunting prevalence is pervasive across all wealth quintiles (Figure 6.2). In the wealthiest households, stunting is a significant concern (34.5 percent), compared with 46.7 percent in the poorest quintile, underscoring the fact that much of Niger faces extreme poverty and that wealth status may be relative and insufficient to eliminate malnutrition by itself. Among children from rural households, 46 percent are stunted compared with 30 percent of their urban counterparts.

Figure 6.1: Trends in Undernutrition in Niger, 1992-2012

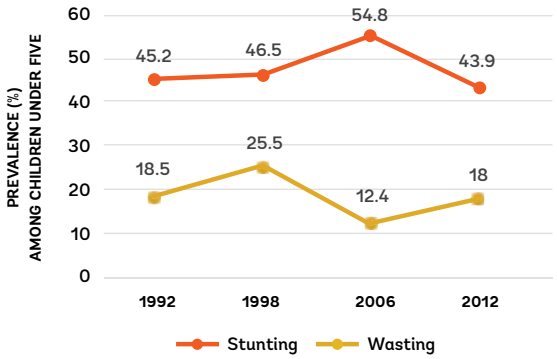
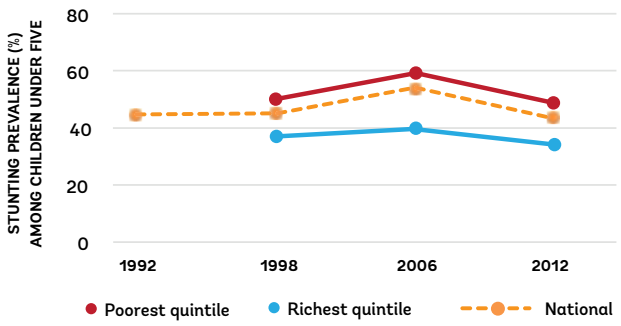


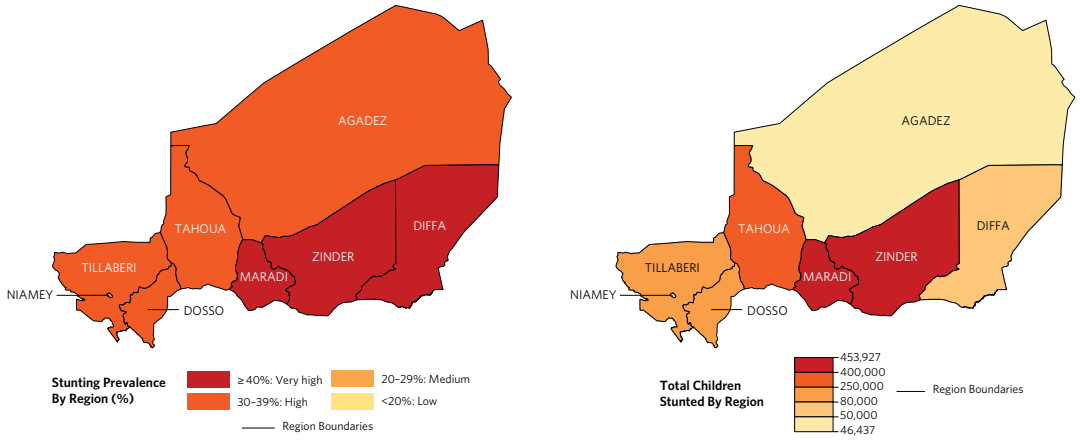
Figure 6.2: Disparities in Stunting by Wealth Quintile, 1992-2012



Source for Figures 6.1 and 6.2: NDHS, 1992, 1998, 2006 and 2012.

The highest stunting prevalence is concentrated in the Diffa, Maradi, and Zinder regions, where stunting prevalence there is estimated to be over 50 percent (Figure 6.3). This is in stark contrast to the capital, Niamey, which has the lowest prevalence of stunting, at 20 percent (NDHS 2012). Given the regional variation in stunting prevalence and burden, targeted interventions are needed to address the key drivers of undernutrition in these highest prevalence and burden regions. Furthermore, Maradi and Zinder regions carry the greatest absolute burden of children who are stunted. While Diffa region's prevalence is among the highest, the absolute burden is lower, particularly as compared to the Tahoua region. Given the data on regional variations in stunting prevalence in Niger, it would be important to understand the key drivers of undernutrition in these highest prevalence and burden regions and to design targeted interventions to address them.

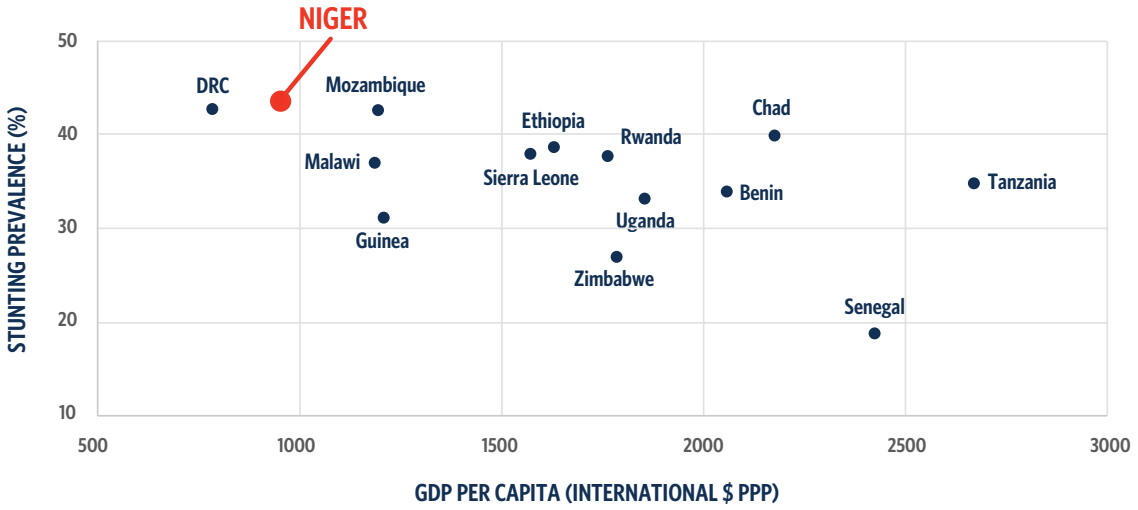
Figure 6.3: Number of Stunted Children and Stunting Prevalence by Region, Niger 2012



Data source: NDHS 2012. IBRD 42942 | MAY 2017 These maps were produced by the Cartography Unit of the World Bank Group. The boundaries, colors, denominations and any other information shown on these maps do not imply, on the part of the World Bank Group, any judgment on the legal status of any territory, or any endorsement or acceptance of such boundaries.

Niger's stunting prevalence is significantly higher than the average for the region, which is 35.2 percent (World Bank 2017), and the country is one of the poorest in the region (Figure 6.4). Approximately one in five people in Niger face extreme food insecurity (Save the Children 2009). During the 2009–10 food crisis, more than 30 percent of the population required food assistance (World Bank 2013). It is estimated that, in 2011, the poorest 30 percent of the population shared one-seventh of total national consumption, while the highest income group shared more than 51 percent of total national consumption (World Bank 2014). Although Niger has made some gains in child survival and maternal health, significant challenges remain in improving nutrition outcomes as well as in curbing the high fertility rates, which can seriously impede any progress made in nutrition.

Figure 6.4: Prevalence of Stunting and GDP per Capita: Niger and Selected Low-Income Countries



Source: NDHS 2012; World Bank 2017.

Wasting, also known as acute malnutrition, is typically classified as either severe or moderate. Wasting can result from food insecurity in resource-poor settings with insufficient dietary quality, quantity and diversity, suboptimal breastfeeding, and recurrent episodes of illness such as diarrhea. Wasting prevalence across

Sub-Saharan Africa is second highest in the world, after South Asia, with 13 million children (7.8 percent) suffering from acute malnutrition. Niger ranks fifth in the top five countries with the highest wasting prevalence, with the prevalence at 18 percent in 2012. Particularly with sharp rise in wasting prevalence since 2012, treatment of acute malnutrition, as well as efforts to better understand and address the drivers of wasting, are evermore critical to reversing this trend.

Micronutrient deficiencies, a form of malnutrition that relates to a deficiency in essential vitamins and minerals needed for body functions, are highly pervasive in Niger. Anemia, a condition caused by inadequate dietary intake of iron and by parasitic infections, among other causes, has cross-generational impacts. Nearly half (46 percent) of women of reproductive age in Niger are anemic (NDHS 2012), which affects not only women's own health but also contributes to the intergenerational cycle of undernutrition. Nearly three-quarters of children (73 percent) 6 to 59 months of age are anemic, with anemia prevalence highest in the Diffa region (88 percent) (NDHS 2012). Ensuring that women of reproductive age are well nourished through diverse diets rich in micronutrients and are provided with necessary micronutrient supplements sets the stage for their children to achieve optimal nutrition, growth, and development and for the country to build human capital.

Demand- and supply-side barriers influence feeding behaviors, including breastfeeding practices, food consumption, and dietary diversity. Market dependence varies by livelihood and wealth quintile. Sheep and cattle farmers largely rely on markets, while wealthier cultivators tend to grow enough to support themselves as well as to purchase additional food to improve dietary diversity (Save the Children 2009). The cost of food can account for 60 to 75 percent of expenditures for the poorest families, and because the percentage of budget allocated for food purchases sharply increases during times of crisis, food consumption can drastically decrease at these times. A crop or grazing failure, climatic event, or an increase in market rate for staple crops translates into a reduction in purchasing power and an impaired ability to meet basic food needs for the most vulnerable families (Save the Children 2009). These underlying causes of malnutrition from food shortages, coupled with difficult access to health centers, inadequate hygiene, lack of proper sanitation, and behavioral factors, further highlight the need for effective multisectoral strategies to address undernutrition across the country.

Political Commitment to Reduce Malnutrition

The policy environment around nutrition is gaining momentum in Niger. Nutrition, along with reducing fertility and maximizing the demographic dividend—two agendas that share complementarity with nutrition—is one of priorities of the Prime Minister's ambitious General Development Plan, demonstrating a high-level recognition that nutrition outcomes influence economic development (SUN 2014). This commitment was further solidified when Niger joined the fight to end malnutrition as a member of the SUN movement in 2011. Starting in 2012, Niger began implementing a multisector, overarching nutrition strategy known as Nigeriens Nourishing Nigeriens (3N). 3N aims to strengthen the agriculture sector's production capabilities to improve nutrition outcomes and resilience to cyclical food crises (SUN, no date). The Health Ministry implements the majority of the nutrition interventions, the Minister of Public Health chairs the 3N committee, and the underlying guidelines of the strategy were derived by the Niger Renaissance Program (SUN 2014). Within the 3N initiative, nearly three-quarters of the budget allocation is for nutrition-specific interventions to improve nutrition practices, reduce acute malnutrition, and improve micronutrient intake; about one-quarter is allocated for governance to implement nutrition-specific and nutrition-sensitive interventions; and the remaining smaller portion is allocated for nutrition-sensitive interventions such as food security (SUN, no date). Although the 3N program lays the foundation necessary to address malnutrition, enable national food production, and increase income, greater investments are needed from domestic resources, ODA, and other innovative financing mechanisms for Niger to substantially reduce malnutrition.

Current Financing for Nutrition

In 2015 in Niger, the government and overseas donors spent a total of $28.9 million on interventions that will contribute to reaching the global targets for nutrition. Of that amount, $10.7 million came from the government and $18.3 million came from ODA. The contribution from ODA included $5.7 million for stunting, $1.2 million for anemia, $1.6 million for breastfeeding, and $10.7 million for treating wasting.[2] The single largest nutrition investment in Niger is for the treatment of wasting. These estimates reflect the current spending on nutrition; the following sections detail additional financing needed in order for Niger to contribute to reaching the global targets on nutrition.[3]

Global Targets for Nutrition

Substantial improvements to the nutritional status of women and children can be realized if adequate investment is made in a set of evidence-based nutrition-specific interventions that ensure optimum nutrition during the critical 1,000-day window between the start of a woman's pregnancy and the child's second birthday (Black et al. 2008, 2013). For women, these include interventions to prevent anemia before and during pregnancy as well as those aimed at improving protein energy intake during pregnancy. Interventions targeted toward children and their mothers aim to improve breastfeeding and complementary feeding practices, enhance the micronutrient status of children, and treat acute malnutrition in children.

In 2012—to rally the international community around improving nutrition—the 176 members of the World Health Assembly endorsed the first-ever global nutrition targets, focusing on six areas: stunting, anemia, low birthweight, childhood overweight, breastfeeding, and wasting. These targets aim to boost investments in cost-effective interventions, spearhead better implementation practices, and catalyze progress toward reducing malnutrition. The targets for stunting and wasting are enshrined within the United Nations' Sustainable Development Goal 2 (SDG 2), which commits to ending malnutrition in all its forms by the year 2030. The 2016 *Global Nutrition Report* ranked each country's progress in contributing to the achievement of the global targets (Table 6.1) (IFPRI 2016).[4]

Table 6.1: Four Global Targets for Nutrition and Niger's Contribution Toward Meeting Them

		NIGER'S RANK	PREVALENCE	PROGRESS
1 **STUNTING***	Reduce the number of stunted children under five by 40%	122/132	43.9%	🟡
2 **ANEMIA**	Reduce the number of women of reproductive age with anemia by 50%	169/185	46.7%	🔴
5 **BREASTFEEDING**	Increase the rate of exclusive breastfeeding in the first six months up to at least 50%	103/141	23.3%	🟢
6 **WASTING***	Reduce and maintain childhood wasting (acute malnutrition) to less than 5%	126/130	18.0%	🔴

LEGEND: 🔴 Off course, no progress 🟡 Off course, some progress 🟢 On course, good progress

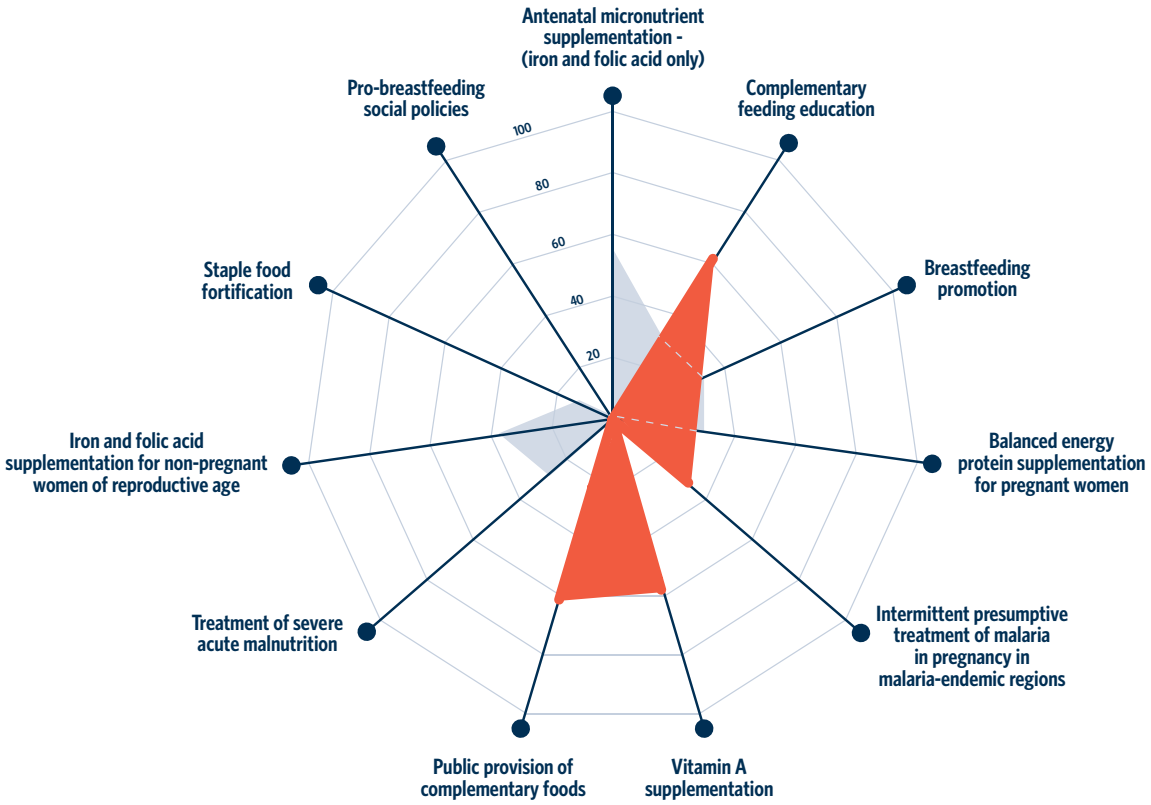
**Stunting and wasting are included within the United Nations' Sustainable Development Goal 2 (SDG 2), which commits to ending malnutrition in all its forms by the year 2030.*
Source: Global Nutrition Report 2016. Nutrition targets are from WHO 2014; rank and progress from IFPRI 2016; prevalence data from NDHS 2012.

Coverage of key nutrition-specific interventions in Niger is largely inadequate and remains well below the levels necessary to advance in reducing malnutrition among Nigerien children. Table 6.2 and Figure 6.5 summarize the current coverage and delivery platforms of nutrition-specific interventions in Niger.

Table 6.2: Delivery Platforms for Nutrition-Specific Interventions in Niger

INTERVENTION	DELIVERY PLATFORM
Antenatal micronutrient supplementation (iron and folic acid only)	Health facility and community
Complementary feeding education	Health facility, community, and communication campaigns
Breastfeeding promotion	Health facility, community, and communication campaigns
Balanced energy protein supplementation for pregnant women	Health facility, community, and social safety net programs
Intermittent presumptive treatment of malaria in pregnancy in malaria-endemic regions	Health facility and community
Vitamin A supplementation	Health facility, community, and food fortification
Public provision of complementary foods	Health facility, community, and social safety net programs
Treatment of severe acute malnutrition	Health facility and community
Iron and folic acid supplementation for non-pregnant women of reproductive age	School, community, health facility, and marketplace
Staple food fortification	Marketplace
Pro-breastfeeding social policies	Government policies
National breastfeeding promotion campaigns	Media

Figure 6.5: Coverage of Key Nutrition-Specific Interventions in Niger and Sub-Saharan Africa

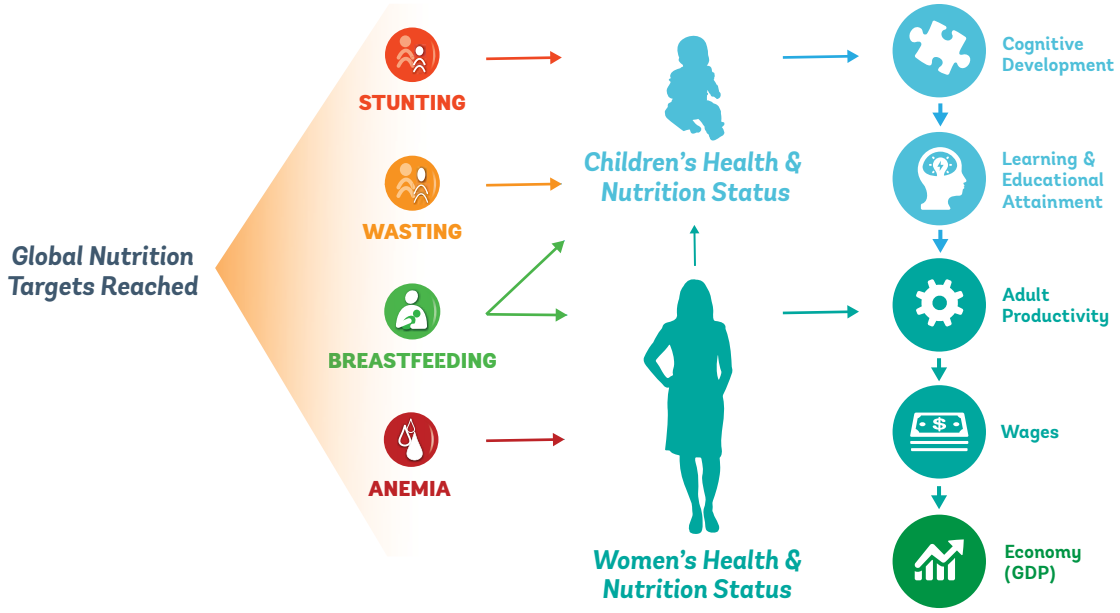


Note: Red shading represents Niger and light blue shading represents average Sub-Saharan Africa regional coverage

Economic Benefits of Investing in Nutrition

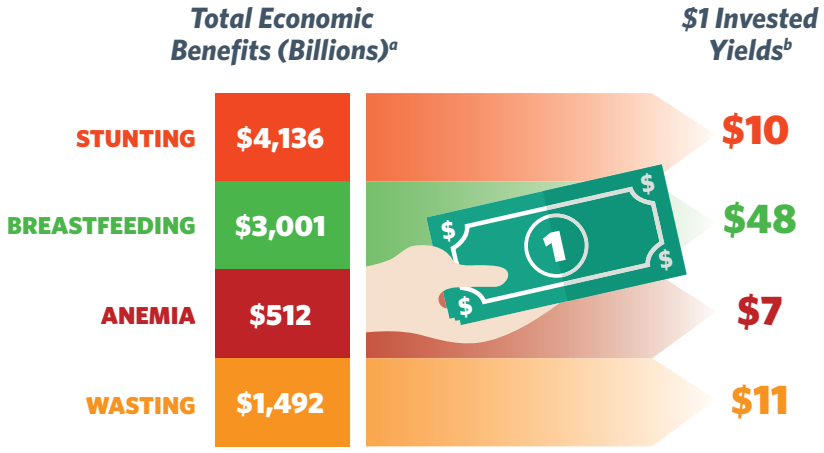
There is a strong body of evidence that shows high economic returns to investing in nutrition (Alderman et al. 2016; Copenhagen Consensus Center 2015; Hoddinott et al. 2013). Scaling up these proven nutrition-specific interventions can ensure that mothers are healthy and well nourished and that they can provide optimal nutrition to their children, that children realize their full physical and cognitive development potential, and that women's productivity is not hampered by illness, especially anemia (Figure 6.6).

Figure 6.6: How Reaching the Global Nutrition Targets Generates Economic Benefits



In Niger, scaling-up the package of nutrition-specific interventions would produce substantial economic benefits over the productive lifetime of the affected women and children (Figure 6.7). Additional health system cost-savings would also be likely because many of these investments reduce the burden of childhood illnesses such as diarrhea and pneumonia.

Figure 6.7: Investments in Niger to Meet the Global Nutrition Targets Have Enormous Economic Returns



a. Total economic benefits over 10 years for women and over the productive lives of children who benefit from these interventions, , defined as the period between the age of 18 and a "retirement" age - the life expectancy or the age of 65, whichever is lower.

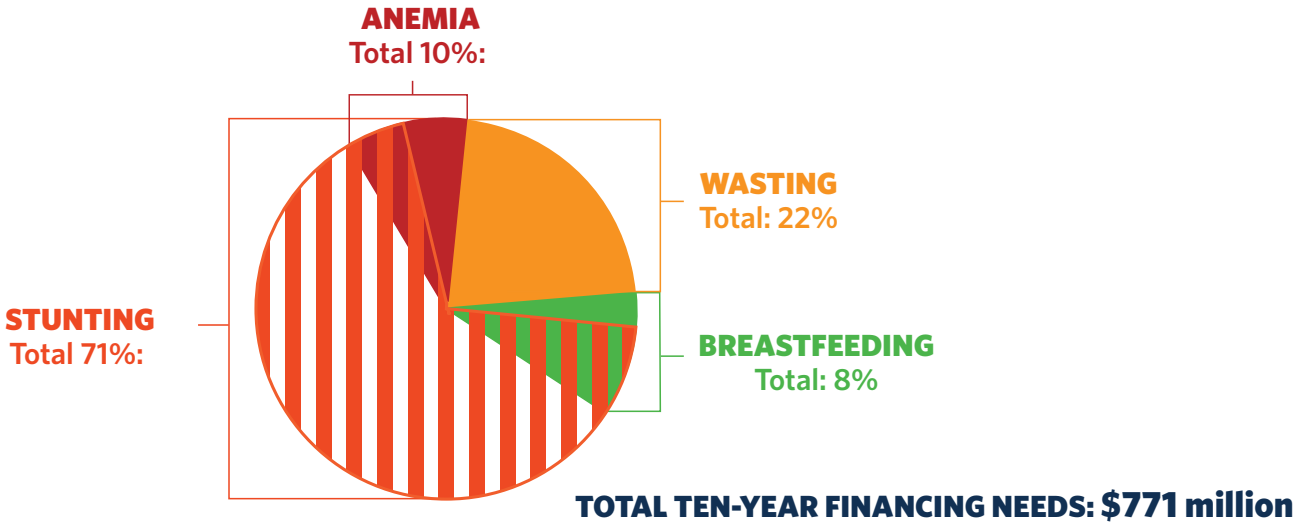
b. Benefit calculation assumes a 3 percent discount rate for both costs and benefits, and GDP growth rate of 3 percent.

Financing Needs, Impacts, and Cost-Effectiveness of Scaling Up Nutrition-Specific Interventions

Using the methodology detailed in *An Investment Framework for Nutrition* (Shekar et al. 2017), this brief presents estimates of the resources needed to scale up a package of 12 high-impact nutrition-specific interventions in Niger to meet the global nutrition targets for stunting, anemia, breastfeeding, and wasting, along with their estimated nutrition, health, and economic impacts. An additional $77.1 million per year over 10 years is needed to scale up the package of key interventions (Table 6.3). The health and nutrition impact of this investment is shown in Table 6.4.

The scale up of complementary feeding education would be the most cost-effective intervention for the prevention of stunting, averting more than 71,000 cases and costing $17.6 million over 10 years. Prophylactic zinc supplementation would be the most effective intervention for stunting, and would prevent 194,000 cases over 10 years—but this intervention also has the highest total cost. Breastfeeding promotion through counseling mothers would be projected to increase the number of infants exclusively breastfed by 1.18 million, prevent 14,000 deaths, and cost $38 million over 10 years. Among the set of nutrition-specific interventions, vitamin A supplementation would be the most cost-effective intervention for preventing child mortality, but would avert only 5,000 deaths over 10 years. Given that acute malnutrition is of serious public health significance in Niger, treatment of wasting would have the highest impact for child mortality, resulting in more than 30,000 deaths averted. For preventing maternal anemia, staple food fortification would be the most cost-effective, at a cost of $4.50 for each case-year of anemia prevented in women. Over 10 years, staple food fortification would prevent nearly 1.7 million case-years of anemia in women at a cost of $7.4 million.

Figure 6.8: Ten-Year Financing Needs for Scaling Up a Package of Nutrition-Specific Interventions in Niger by Percent per Intervention



Note: Some costs for anemia, breastfeeding, and stunting are shared across interventions. Costs for breastfeeding promotion ($38 million) has been included in both the total cost for the breastfeeding target and the total cost for the stunting target; cost of intermittent presumptive treatment of malaria in pregnancy in malaria-endemic regions ($15.3 million) has been included in both the total cost for the anemia target and the total cost for the stunting target.

Interventions to reduce stunting would require the most resources,[4] accounting for about 71 percent of the total amount required for scale-up. However, some of the stunting interventions would also affect breastfeeding and anemia targets. Figure 6.8 represents the distribution of total cost across interventions to address the four targets.

Table 6.3: Estimated 10-Year Financing Needs and Cost-Effectiveness of Scaling Up Nutrition-Specific Interventions, Niger

INTERVENTION (NUTRITION TARGET)	TOTAL 10-YEAR FINANCING NEEDS (US $M)	COST PER DEATH AVERTED (US $)	COST PER CASE OF STUNTING AVERTED (US $)
For pregnant women and mothers of infants			
Antenatal micronutrient supplementation (stunting, anemia)	26.4	5,980	5,143
Infant and young child nutrition counseling (complementary feeding education and breastfeeding promotion combined)	55.6	3,272	712
Complementary feeding education (stunting)	17.6	5,909	245
Breastfeeding promotion (stunting, breastfeeding)	38.0	2,711	5,999
Balanced energy protein supplementation for pregnant women (stunting)	112.7	24,090	19,322
Intermittent presumptive treatment of malaria in pregnancy in malaria-endemic regions (stunting, anemia)	15.3	4,117	744
For infants and young children			
Vitamin A supplementation (stunting)	5.9	1,194	110
Prophylactic zinc supplementation (stunting)	181.7	11,255	937
Public provision of complementary food (stunting)	148.0	40,458	1,880
Treatment of severe acute malnutrition (wasting)	167.6	5,479	n.a
For non-pregnant women and general population			
Iron and folic acid supplementation for non-pregnant women (anemia)	25.1	29,719	n.a
Staple food fortification (anemia)	7.4		n.a
Pro-breastfeeding social policies (breastfeeding)	5.0	n.a	n.a
National breastfeeding promotion campaigns (breastfeeding)	20.2	n.a	n.a
TOTAL:	**771.1**	**8,940**	**1,524**

Note: Financing needs and impacts assume a linear scale-up of interventions from current coverage level to 90 percent over five years, then maintained at 90 percent for an additional five years. Unit financing needs for each intervention were drawn from available unit costs from neighboring countries, global costs, or estimates available in the literature. The estimated costs include an additional 12 percent (11 percent for pro-breastfeeding social policies and promotion campaigns) to account for monitoring, evaluation, capacity, and policy development that may be necessary to reach full scale-up of the interventions. The Lives Saved Tool (LiST) was used to estimate the impact of interventions that target pregnant women and children. The impact of interventions that target the general population or non-pregnant women were estimated using a Microsoft Excel model. n.a. = not applicable. It should be noted that the LiST model does not capture potential synergies between specific interventions (e.g. the fact that the impact of behavior change communication interventions may be higher in populations that have access to affordable and diversified foods or in populations with higher levels of educational attainment). Therefore, it is possible that the impact estimates generated using LiST in fact underestimate the true impact of the interventions in some contexts.

n.a. = not applicable.

Two Alternative Investment Packages

Relative to current expenditures on health, the investment required to scale-up the set of effective nutrition-specific interventions may present significant challenges for Niger. In an environment of constrained resources in which Niger may not be able to raise $771.1 million over the next 10 years, two alternative investment packages are laid out for consideration.

The Priority Package: The first—the "priority package"—includes interventions that are the most cost-effective; that is, that have the lowest cost per health outcome (e.g., case of stunting averted), and that have

Table 6.4: Benefits and Cost-Effectiveness by Investment Package, Niger

GLOBAL TARGET	BENEFIT	PRIORITY PACKAGE	CATALYZING PROGRESS PACKAGE	FULL PACKAGE: All interventions needed to meet targets
		$29.7 million/year in financing need	**$46.6 million/year in financing need**	**$77.1 million/year in financing need**
STUNTING	Cases of stunting reduced by 2025 (vs 2015)[a]	140,000	188,000	425,000
ANEMIA	Cases of anemia in women prevented by 2025	2.2 million	3 million	7.5 million
BREASTFEEDING	Additional babies breastfed over 10 years	1.2 million	1.2 million	1.2 million
ALL TARGETS	**Child deaths averted over 10 years**	**62,000**	**68,000**	**86,000**
	Cost per death averted	4,787	6,811	8,940
	Cost per case of stunting averted	738	1,054	1,524

a. Total impact of proposed intervention package combined with other health and poverty reduction efforts.

well-established global policy guidelines and delivery platforms. Based on those two criteria, the priority package includes antenatal micronutrient supplementation, infant and young child nutrition counseling, intermittent presumptive treatment of malaria in pregnancy in malaria-endemic regions, vitamin A supplementation, treatment of severe acute malnutrition, weekly iron and folic acid supplementation for girls 15–19 years of age attending school, and fortification of wheat and maize flour with iron and folic acid. These interventions would be scaled up to full program coverage in the first five years and maintained at full coverage levels for the last five years. This priority package would require an estimated $297 million over 10 years, or $29.7 million annually (see Table 6.4).

During the 10 years of scale-up, this package would prevent more than 140,000 cases of stunting and avert 62,000 deaths in children under five years of age. It would also prevent more than 2.2 million case-years of anemia in women and result in 1.2 million children under six months of age being exclusively breastfed.

The Catalyzing Progress Package: The second alternative—the "catalyzing progress package"—includes scale-up of all interventions in the priority package, plus a phased approach to scaling up public provision of complementary foods, balanced energy protein supplementation, prophylactic zinc supplementation, and weekly iron and folic acid supplementation for women outside of schools. It is assumed that, for the latter set of interventions, during the first five years emphasis will be placed on establishing global guidelines and on operational research to develop effective delivery platforms, or to develop less expensive products or more cost-effective technologies. Financing needs are approximated as the cost of scaling up this set of interventions from 0 to 10 percent coverage only in the first five years. In the subsequent five years it is assumed that the coverage expansion of those interventions will accelerate and reach 60 percent by 2025. This package would require $46.6 million per year, for a total of $466 million over 10 years (Table 6.4). It would prevent 68,000

deaths and more than 188,000 cases of stunting among children under age five, increase the number of exclusively breastfed children under six months of age by 1.2 million, and prevent more than 3 million case-years of anemia in women.

In comparing the relative cost-effectiveness of the three investment packages, the two alternative packages are more cost-effective in preventing deaths and stunting. However, neither is as effective as the full package in making progress toward achieving the stunting, wasting, and anemia targets. The priority and catalyzing progress packages would prevent 62,000 and 68,000 deaths respectively, compared with 86,000 deaths prevented with the full package over 10 years. Under the full package scenario, 425,000 cases of childhood stunting would be prevented, compared with 188,000 cases under the catalyzing progress scenario and 140,000 cases under the priority package scenario. Furthermore, there would be nearly 5.3 million and 4.5 million more case-years of anemia in women under the priority package and catalyzing progress package, respectively.

A Call to Action

As the world stands on the cusp of the new Sustainable Development Goals, there is an unprecedented opportunity to save children's lives, build future human capital and cognitive development, and drive faster economic growth. Scaling up key nutrition interventions during the critical 1,000 day window of early childhood would pay lifelong dividends, translating to healthier societies and more robust economies. If this window is missed, it is missed for life.

The additional financing needed to reach the global nutrition targets will require coordinated efforts by all stakeholders and a supportive policy environment. To achieve these targets, Niger will need to increase its general government health expenditure by approximately 40 percent.[5] These investments are over and above those needed for improving water and sanitation and for addressing issues around women's empowerment and food security. Although this level of domestic financing is ambitious, investing in nutrition interventions have significant potential to reduce poverty and boost shared prosperity.

Accelerating the reduction of stunting along with family-planning programs to help realize potential of the demographic dividend in Niger will be essential for maximizing the return on investments in early childhood development, in education, and more broadly in policies aimed at fostering and enhancing human capital accumulation and job creation. Investing in the early years is even more critical because the Africa region is entering a demographic transition with an expected increase in the working-age population from 54 percent in 2010 to 64 percent in 2090. The scale-up of the key nutrition-specific interventions to reduce stunting is estimated to generate considerable returns in economic benefits over the productive lives of beneficiaries, and is a necessary condition to build human capital through investments in the early years and to harness the potential benefits of the demographic dividend.

Endnotes

Note: All dollar amounts are U.S. dollars unless otherwise indicated.

[1] Information about the Power of Nutrition initiative is available at https://ciff.org/grant-portfolio/the-power-of-nutrition/.

[2] Note that because some funded interventions contribute to more than one target, the sum of funding across the four targets is less than the total funding for each target added together.

[3] Current financing by source is from Results for Development Institute and can be found at http://www.investinnutrition.org/.

4 Two of the global nutrition targets—those for low birthweight and for child overweight—were not included in the analyses because of insufficient data on the prevalence of low birthweight and a lack of consensus on effective interventions to reach the target for child overweight.

[5] WHO National Health accounts database indicates that general government health expenditure in Niger was $191 million in 2014. At that level, government spending on health will need to be increased by 40 percent to accommodate the $77.1 million per year required to scale up the 12 nutrition-specific interventions.

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RWANDA: *An Investment Framework for Nutrition*

Key Messages

- Thirty-eight percent of children in Rwanda are chronically malnourished (stunted); this represents a steady but slow decline since 2005, when half of all children were stunted. Acute malnutrition (wasting) has declined rapidly between 2000 and 2015 (from 8.3 to 2.2 percent), and Rwanda is among the few countries in the world that have passed the 2030 Sustainable Development Goal (SDG) target for wasting.
- Although stunting is concentrated in Rwanda's western districts and among the poor, one-fifth of children in the richest quintile are stunted (as compared with nearly half in the poorest quintile), suggesting that factors other than income affect malnutrition. Despite major successes in exclusive breastfeeding rates (almost 90 percent nationwide), suboptimal complementary feeding practices, poor hygiene and sanitation, and high fertility rates all contribute to persistently high rates of stunting.
- Scaling up a package of high-impact nutrition-specific interventions in Rwanda to contribute toward achieving the global nutrition targets would require an additional $27.3 million per year over 10 years and would yield enormous benefits (see panel on the right). These investments are over and above those needed for improving water and sanitation and for addressing issues around women's empowerment and food security.
- This scale-up would require additional financing equivalent to a 12 percent increase in current government expenditure on health and could be financed from a combination of domestic sources, official development assistance (ODA), and innovative financing sources such as the Power of Nutrition.[1]
- To finance the nutrition scale-up, two lower-cost scenarios are estimated to require between $5.7 and $12.2 million per year over the next 10 years. In an environment of constrained resources, starting with one of these two scenarios would be a strong first investment, but it would need to be followed by increased investments toward full scale-up to achieve the global nutrition targets.
- Making these investments in reducing malnutrition would produce around $3.4 billion in economic benefits over the productive lives of women and children and help the Government of Rwanda meet its ambitious Vision 2020 strategy.

Benefits of Investing in Nutrition

✓ **183,000**
cases of stunting prevented in 2025

✓ **6,200**
child deaths prevented in 2025

✓ **1.5 MILLION**
case-years of anemia in women prevented in 2025

✓ **28,000**
babies exclusively breastfed

✓ **45,000**
cases of severe wasting treated

$4–$24
return for every dollar invested

$3.4 BILLION
generated from investments to reduce stunting*

**The economic benefits are calculated over the productive lives of the children benefiting from the interventions that prevent stunting.*

Investment Case for Nutrition

Ensuring optimum nutrition—particularly during the 1,000-day period from pregnancy to a child's second birthday—can alter an individual's development trajectory and maximize her or his productive potential. Chronic malnutrition has important lifelong consequences for health and cognitive development. Losses to cognitive development in early childhood resulting from chronic malnutrition are irreversible. Being stunted (low height-for-age) in early childhood is associated with a delayed start at school, reduced schooling attainment, and substantially decreased adult incomes at both the individual and country level (Daniels and Adair 2004; Fink et al. 2016; Hoddinott et al. 2008; Martorell et al. 2010). These consequences add up to overall gross domestic product (GDP) losses of 4 to 11 percent in Africa and Asia (Horton and Steckel 2013). Importantly, chronic undernutrition can be transmitted through an inter-generational cycle, where malnourished mothers are more likely to have stunted children (Aguayo et al. 2016; Ozaltin et al. 2010).

Investments in nutrition are highly cost-effective and among the best value-for-money development actions (Copenhagen Consensus Center 2015; Hoddinott et al. 2013). An Investment Framework for Nutrition developed by the World Bank in partnership with R4D, 1000 Days, and the Bill & Melinda Gates Foundation estimated high returns on every dollar invested in nutrition: from $4 in returns for treating acute malnutrition (wasting) to $11 for preventing stunting, $12 for the treatment and prevention of anemia, and $35 for increasing the prevalence of exclusive breastfeeding (Shekar et al. 2017). Not only do investments in nutrition produce substantial economic benefits, but they also lay the groundwork for the success of investments in other sectors. The Government of Rwanda, with support from ODA and implementation partners, has an expanding portfolio of investments in nutrition that is expected to total more than $100 million between 2014 and 2021.[2]

Investments in the early years—including early life nutrition, early learning and stimulation, and the provision of nurturing care and protection from stress—ensure that all children reach their human potential and contribute to the economic growth of their nation. The analysis presented below focuses on high-impact nutrition-specific interventions with strong evidence of efficacy in reducing malnutrition, and estimates the financing needs, impacts, and economic benefits of scaling up these interventions in Rwanda.

Country Context

Rwanda is a small landlocked country in East Africa. The Rwandan population is estimated to be 11.6 million with a growth rate of 2.4 percent, a total fertility rate (TFR) of 4.2, and one of the highest densities on the continent (470.6 people per square kilometer). Although the country's TFR has declined from a high of 5.8 in 2000 and is currently below the average for Sub-Saharan Africa (4.9), it still remains a significant impediment to achieving progress on malnutrition reduction. Rwanda has a young population: 43 percent are under age 15 and about 4 percent under age five (UN DESA 2015).

More than 84 percent of the population resides in rural areas, and agriculture accounts for 70 percent of employment in Rwanda (RDHS 2015). Rwanda's economy has maintained a steady growth rate over the past five years and is projected to increase from 6.8 percent in 2016 to 7.1 percent in 2017, exceeding average global growth rate projections (World Bank 2016).

The Government of Rwanda is prioritizing achieving the ambitious goals laid out in Vision 2020, a guiding national strategy that aims to transform the country into a knowledge-based, service-oriented middle-income country by 2020 (Republic of Rwanda 2012). Rwanda has made substantial progress in economic, social, and human development. The poverty rate ($1.90 2011 PPP) has declined from 60.4 percent in 2010 to 54.3 percent in 2014, driven by a growing working-age labor force and a rapid inter-sectoral shift from work in the agriculture sector to work in other sectors of the economy (World Bank 2016). With agriculture still underlying most livelihoods, the population is highly vulnerable to weather shocks (V20, 2017).

Nutritional Status in Rwanda

Persistently high rates of undernutrition remain a serious human development challenge in Rwanda. Thirty-eight percent—or 640,000—children under age five are stunted and 2 percent are wasted (low weight-for-height), which suggests that wasting, or acute malnutrition, is less of a problem in Rwanda than chronic malnutrition (RDHS 2015). Overall, stunting prevalence has declined since 2000 but remains of high public health significance according to WHO standards. The prevalence of wasting has declined significantly since 2000, and by 2005 Rwanda had reduced wasting to less than 5 percent, overshooting the 2030 global target (Figure 7.1).

National estimates mask socioeconomic and geographic disparities in stunting prevalence. Significant differences in stunting remain among children in poorer and wealthier households. In the past 15 years, stunting declined more quickly among children living in households in the top wealth quintile (with a 3.2 percent average annual rate of reduction) when compared with those in the bottom quintile (a 1 percent average annual rate of reduction) (Figure 7.2). Nevertheless, stunting prevalence remains high (21 percent) in the highest wealth quintile, underscoring the fact that rising incomes alone are insufficient to eliminate child malnutrition and build sustainable futures.

Figure 7.1: Trends in Undernutrition in Rwanda, 2000–2015

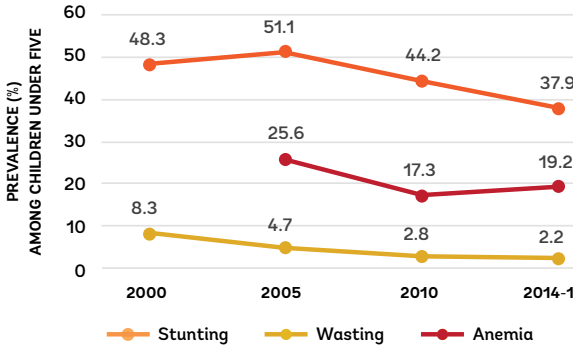
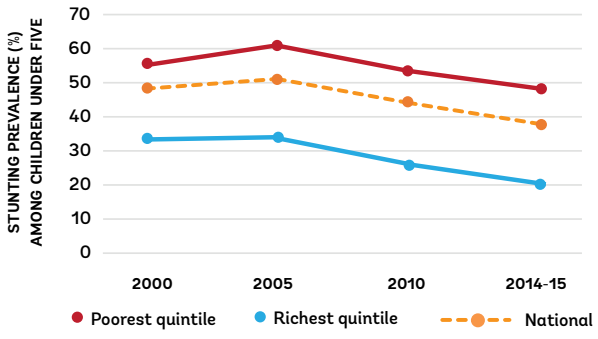


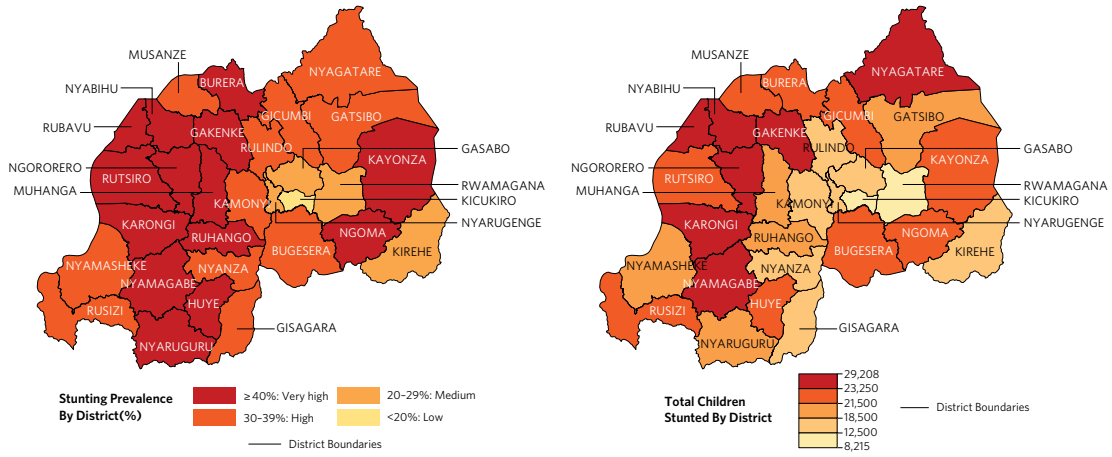
Figure 7.2: Disparities in Stunting by Wealth Quintile, 2000–2015



Source for Figures 7.1 and 7.2: RDHS 2015.

The highest rates of stunting are concentrated in the western districts of the country, but stunting levels remain high across almost all districts (Figure 7.3). Out of 30 districts in the country, 25 had a stunting prevalence of high (more than 30 percent) or very high (more than 40 percent) public health significance. Furthermore, seven districts carry the highest burden in terms of absolute number of stunted children.

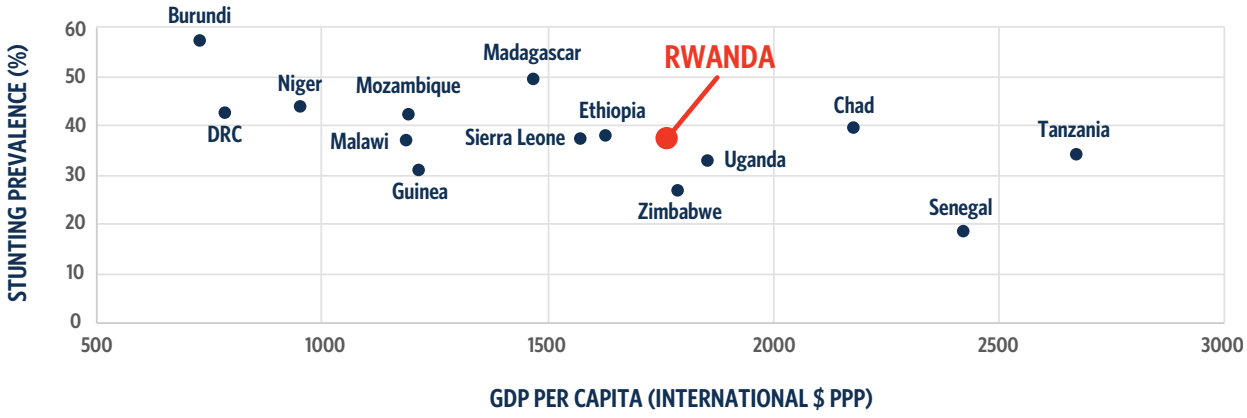
Figure 7.3: Number of Stunted Children and Stunting Prevalence by District, Rwanda 2014–15



Data source: RDHS 2015. IBRD 42943 | MAY 2017 These maps were produced by the Cartography Unit of the World Bank Group. The boundaries, colors, denominations and any other information shown on these maps do not imply, on the part of the World Bank Group, any judgment on the legal status of any territory, or any endorsement or acceptance of such boundaries.

The prevalence of stunting in Rwanda is higher than the average for the region (35.2 percent) (Figure 7.4), and higher than that of other Sub-Saharan African countries with similar or lower per capita GDP, such as Guinea, Malawi, Uganda, and Zimbabwe (World Bank 2017). Although the nutritional status of children under five can improve with greater economic growth, more active interventions are necessary to capitalize on such gains.

Figure 7.4: Prevalence of Stunting and GDP per Capita: Rwanda and Selected Low-Income Countries



Source: RDHS 2015; World Bank 2017.

Wasting, also known as acute malnutrition, is typically classified as either severe or moderate. Wasting can result from food insecurity in resource-poor settings with insufficient dietary quality, quantity and diversity, suboptimal breastfeeding, and recurrent episodes of illness such as diarrhea. Wasting prevalence across Sub-Saharan Africa is second highest in the world, after South Asia, with 13 million children (7.8 percent) suffering from acute malnutrition. However, this varies at the country level. Since 2005, Rwanda has shown a consistently downward trend in wasting prevalence and has exceeded its goal to reduce wasting to under 5 percent. In 2014-15, the wasting prevalence in Rwanda was 2.2 percent.

Micronutrient deficiencies (a form of malnutrition that relates to a deficiency in essential vitamins and minerals needed for body functions and sometimes referred to as *hidden hunger*) are pervasive in Rwanda. Anemia—a condition caused by inadequate dietary intake of iron, helminth infections, and malaria, among other causes—has cross-generational impacts. Ensuring that women of reproductive age are well nourished sets the stage for their children to achieve optimal nutrition and development. Approximately one in five women of reproductive age in Rwanda is anemic, which not only affects women's own health, but also contributes to the inter-generational cycle of undernutrition (RDHS 2015). Although more than one in three children (37 percent) 6 to 59 months of age are anemic, there has been a 30 percent reduction since 2005 (RDHS 2015).

Rwanda has made significant investments in health services and has seen impressive progress in improving several health outcomes in recent years. However, a multitude of factors have restricted similar levels of improvement in childhood malnutrition. High fertility rates, along with suboptimal complementary feeding practices, poor hygiene and sanitation practices, insufficient access to health services, and inadequate maternal and child care practices remain obstacles to further reducing chronic child malnutrition. Although Rwanda has one of the highest rates of exclusive breastfeeding for children under six months old (87 percent), the transition to complementary foods after this period presents a significant challenge, with only 18 percent of children 6 to 24 months old having an adequate quantity and diversity of complementary foods.

Demand- and supply-side barriers influence food consumption and diversity of diet. A recent analysis found that the cost of the most nutritious diet in Burera District is 25 percent greater than the total income of very poor households, thereby persistently limiting access to the range of nutrients required for growth, health, and development during the early years and beyond (Save the Children 2011a). The high cost of food is a significant barrier: an analysis conducted by Save the Children in the same district estimated that 50 percent of very poor households rely on markets to purchase half of their food, largely as a result of limited land to grow a sufficient amount and variety of food. This reliance on purchasing food makes families vulnerable to seasonality and price fluctuations (Save the Children 2011b). Recognizing that other factors beyond poverty and food insecurity put children at risk of chronic malnutrition, effective multisectoral strategies are needed to address undernutrition across the country.

A recent report found that 21.9 percent of all child mortality and 12.7 percent of grade repetitions in Rwanda were associated with undernutrition. Total annual financing needs associated with undernutrition in 2012 were estimated at 11.5 percent of the Rwandan GDP (503.6 billion Rwandan francs, equivalent to US$826.2 million in 2012) and are driven largely by lost working hours that result from mortality associated with undernutrition and the lower productivity of adults engaged in manual labor, such as agricultural work (WFP 2013).

Political Commitment to Reduce Malnutrition

The Government of Rwanda, a SUN movement member since 2011, has demonstrated high-level political commitment, multisectoral coordination, and resource allocation to address chronic malnutrition. The government highlighted food security, nutrition, and early childhood development as foundational issues to address within its Economic and Poverty Reduction Strategy for 2013–2018, which guides midterm actions to achieve the ambitious Vision 2020 goals. Under this strategy, community-based nutrition programs across the country will identify and address poor maternal, infant, and child feeding practices (Republic of Rwanda 2013). Building on this momentum, the Ministry of Health developed the National Food and Nutrition Strategic Plan for 2013–2018 to provide multisectoral and sector-specific strategies to address chronic malnutrition and food security (Ministry of Health 2014). To operationalize this plan, in 2016 the Government of Rwanda approved the Joint Action Plan to Eliminate Malnutrition (JAPEM) and created the National Food and Nutrition Coordination Secretariat (NFNCS) to oversee its implementation (Ministry of Local Government 2016). The commitment to reducing malnutrition is also reflected in the inclusion of an indicator to measure chronic malnutrition and wasting in the Rwanda Vision 2020 strategy (Republic of Rwanda 2012). This reflects official recognition that malnutrition is a barrier to achieving the human resource development necessary to match the country's evolving market labor needs.

Current Financing for Nutrition

In 2015 in Rwanda, overseas donors spent a total of $10.1 million on interventions that will contribute to reaching the global targets for nutrition. No data on domestic resources were available at the time of publishing.[3] This contribution from donors included $6.61 million to reduce stunting, $0.914 million to prevent anemia, $1.85 million to promote breastfeeding, and $1.93 million to treat wasting.[4]

Global Targets for Nutrition

Substantial improvements to the nutritional status of women and children can be realized if adequate investment is made in a set of evidence-based nutrition-specific interventions that ensure optimum nutrition during the critical 1,000 day window between the start of a woman's pregnancy and the child's second birthday (Black et al. 2008, 2013). For women, these include interventions to prevent anemia before and during pregnancy as well as those aimed at improving protein energy intake during pregnancy. Interventions targeted toward children and their mothers aim to improve breastfeeding and complementary feeding practices, enhance the micronutrient status of children, and treat acute malnutrition in children.

In 2012—to rally the international community around improving nutrition—the 176 members of the World Health Assembly endorsed the first-ever global nutrition targets, focusing on six areas: stunting, anemia, low birthweight, childhood overweight, breastfeeding, and wasting. These targets aim to boost investments in cost-effective interventions, spearhead better implementation practices, and catalyze progress toward reducing malnutrition. The targets for stunting and wasting are enshrined within the United Nations' Sustainable Development Goal 2 (SDG 2), which commits to ending malnutrition in all its forms by the year 2030. The 2016 *Global Nutrition Report* ranked each country's progress in contributing toward achieving the global targets (Table 7.1) (IFPRI 2016).[5]

Table 7.1: Four World Health Assembly Targets for Nutrition and Rwanda's Contribution toward Meeting Them

		RWANDA'S RANK	PREVALENCE	PROGRESS
1 **STUNTING***	Reduce the number of stunted children under five by 40%	110/132	37.9	🟡
2 **ANEMIA**	Reduce the number of women of reproductive age with anemia by 50%	16/185	19.2	🔴
5 **BREASTFEEDING**	Increase the rate of exclusive breastfeeding in the first six months up to at least 50%	1/141	87.0	🟢
6 **WASTING***	Reduce and maintain childhood wasting (acute malnutrition) to less than 5%	26/130	2.2	🟢

LEGEND: 🔴 Off course, no progress 🟡 Off course, some progress 🟢 On course, good progress

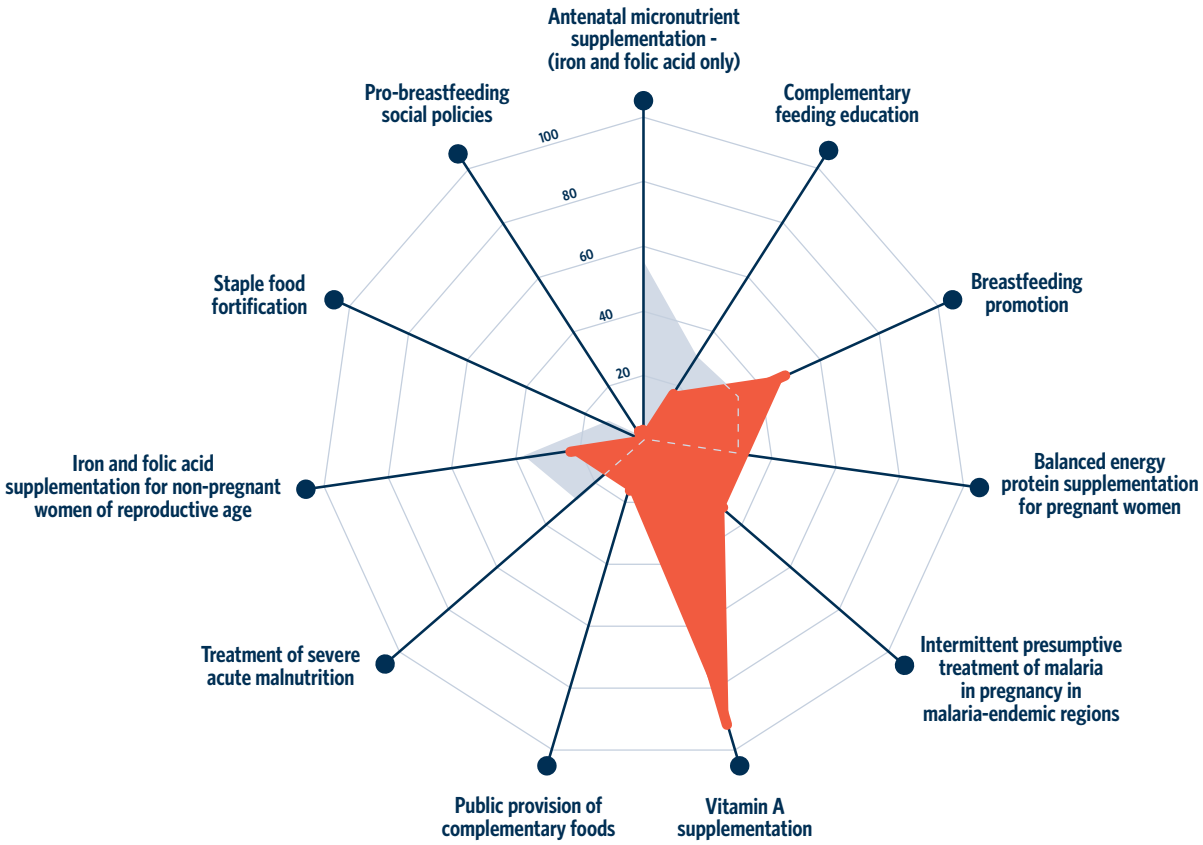
**Stunting and wasting are included within the United Nations' Sustainable Development Goal 2 (SDG 2), which commits to ending malnutrition in all its forms by the year 2030*
Sources: Nutrition targets from WHO 2014; Rank and progress from IFPRI 2016; Prevalence data from RDHS 2015

Coverage of key nutrition interventions in Rwanda is largely inadequate. Coverage of interventions that ensure optimal maternal nutrition and micronutrient status, which reduce the burden of low birthweight in children, is very low. Although coverage rates are higher for some childhood interventions, they remain well below the levels necessary to reduce malnutrition among Rwandan children. Table 7.2 and Figure 7.5 summarize the current coverage and delivery platforms of key nutrition interventions in Rwanda.

Table 7.2: Delivery Platforms of Nutrition-Specific Interventions in Rwanda

INTERVENTION	DELIVERY PLATFORM
Antenatal micronutrient supplementation (iron and folic acid only)	Health facility and community
Complementary feeding education	Health facility, community, and communication campaigns
Breastfeeding promotion	Health facility, community, and communication campaigns
Balanced energy protein supplementation for pregnant women	Health facility, community, and social safety net programs
Intermittent presumptive treatment of malaria in pregnancy in malaria-endemic areas	Health facility, community, and food fortification
Vitamin A supplementation	Health facility, community, and food fortification
Public provision of complementary foods	Health facility, community, and food fortification
Treatment of severe acute malnutrition	Health facility and community
Iron and folic acid supplementation for non-pregnant women of reproductive age	School, community, health facility, and marketplace
Staple food fortification	Marketplace
Pro-breastfeeding social policies	Government policies
National breastfeeding promotion campaigns	Media

Figure 7.5: Coverage of Key Nutrition-Specific Interventions: Rwanda and the Sub-Saharan Africa Region

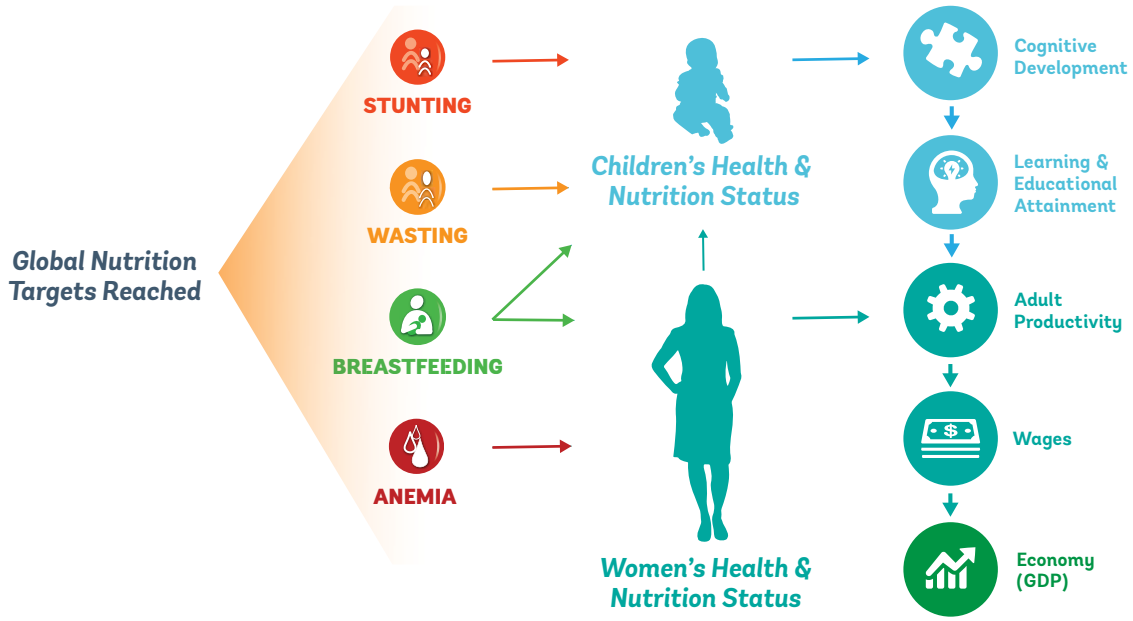


Note: Red shading represents Rwanda and light blue shading represents average Sub-Saharan Africa coverage

Economic Benefits of Investing in Nutrition

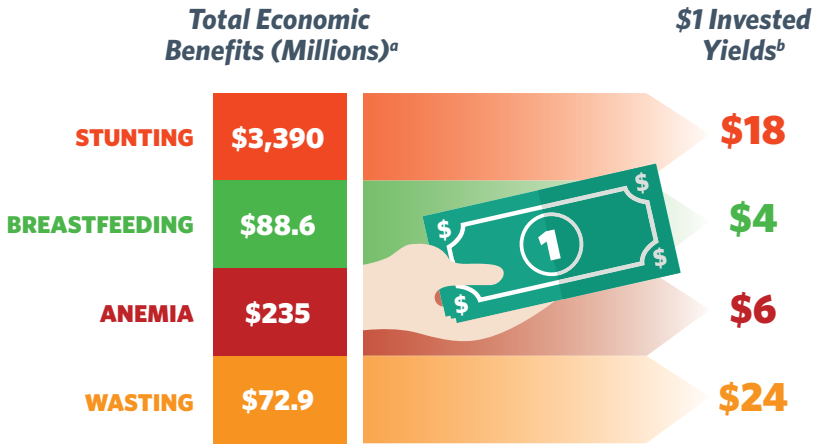
There is a strong body of evidence that shows high economic returns to investing in nutrition (Alderman et al. 2016; Copenhagen Consensus Center 2015; Hoddinott et al. 2013). Scaling up these proven nutrition-specific interventions can ensure that mothers are healthy and well nourished and that they can provide optimal nutrition to their children, that children realize their full physical and cognitive development potential, and that women's productivity is not hampered by illness, especially anemia (Figure 7.6).

Figure 7.6: How Reaching the Global Nutrition Targets Generates Economic Benefits



In Rwanda, scaling up the package of nutrition-specific interventions would produce substantial economic benefits over the productive lifetimes of the affected women and children (Figure 7.7). Additional health system cost-savings would also be likely because many of these investments reduce the burden of childhood illnesses such as diarrhea and pneumonia.

Figure 7.7: Investments in Rwanda to Meet the Global Nutrition Targets Have Enormous Economic



a. Total economic benefits over 10 years for women and over the productive lives of children who benefit from these interventions, defined as the period between the age of 18 and a "retirement" age - the life expectancy or the age of 65, whichever is lower.

b. Benefit calculation assumes a 3 percent discount rate for both financing needs and benefits and a GDP growth rate of 3 percent.

Financing Needs, Impacts, and Cost-Effectiveness of Scaling-Up Nutrition-Specific Interventions

Using the methodology detailed in *An Investment Framework for Nutrition* (Shekar et al. 2017), this brief presents estimates of the resources needed to scale up a package of high-impact nutrition-specific interventions in Rwanda to meet the global nutrition targets for stunting, anemia, breastfeeding, and wasting, along with their estimated nutrition, health, and economic impacts. An additional $27.3 million per year over 10 years is needed to scale up the package of key interventions (Table 7.3). The health and nutrition impacts of this investment are shown in Table 7.4.

Table 7.3: Estimated 10-Year Financing Needs and Cost-Effectiveness of Scaling Up Nutrition-Specific Interventions, Rwanda

INTERVENTION (NUTRITION TARGET)	TOTAL 10-YEAR FINANCING NEEDS (US $M)	COST PER DEATH AVERTED (US $)	COST PER CASE OF STUNTING AVERTED (US $)
For pregnant women and mothers of infants			
Antenatal micronutrient supplementation (stunting, anemia)	9.9	18,452	6,788
Infant and young child nutrition counseling (complementary feeding education and breastfeeding promotion combined)	14.7	22,770	327
Complementary feeding education (stunting)	12.2	25,978	277
Breastfeeding promotion (stunting, breastfeeding)	2.5	14,154	2,918
Balanced energy protein supplementation for pregnant women (stunting)	47.5	70,024	52,172
Intermittent presumptive treatment of malaria in pregnancy in malaria-endemic regions (stunting, anemia)	1.9	12,399	260
For infants and young children			
Prophylactic zinc supplementation (stunting)	54.4	28,336	833
Public provision of complementary food (stunting)	96.0	107,055	1,332
Treatment of severe acute malnutrition (wasting)	3.8	5,370	n.a
For non-pregnant women and general population			
Iron and folic acid supplementation for non-pregnant women (anemia)	16.3	30,331	n.a
Staple food fortification (anemia)	3.9		n.a
Pro-breastfeeding social policies (breastfeeding)	5	n.a	n.a
National breastfeeding promotion campaigns (breastfeeding)	20	n.a	n.a
TOTAL:	**273.3**	**44,059**	**1,168**

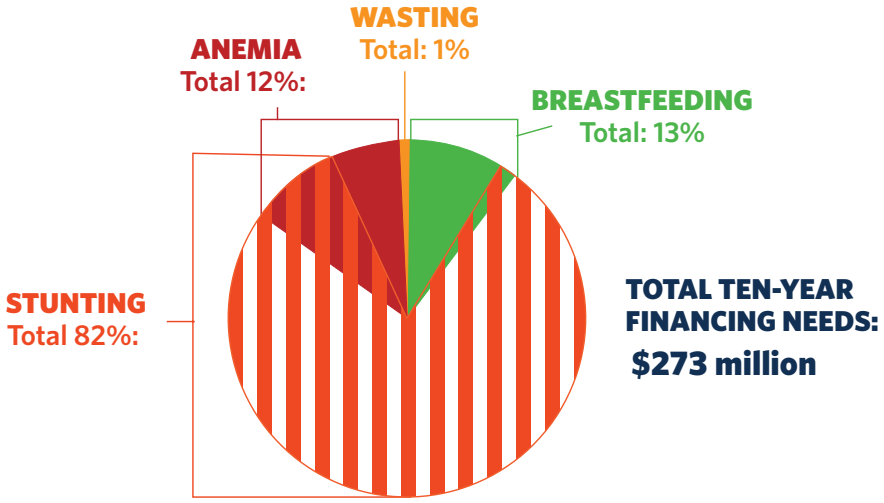
Note: Financing needs and impacts assume a linear scale-up of interventions from the current coverage level to 90 percent over five years, then maintained at 90 percent for an additional five years. Unit costs for each intervention were drawn from available unit costs from neighboring countries, global unit costs, or estimates available in the literature. The estimated financing needs include an additional 12 percent (11 percent for pro-breastfeeding social policies and promotion campaigns) to account for monitoring, evaluation, capacity, and policy development that may be necessary to reach full scale-up of the interventions. The Lives Saved Tool (LiST; see LiST 2015) was used to estimate the impacts of interventions that target pregnant women and children. The impacts of interventions that target the general population or non-pregnant women were estimated using a Microsoft Excel model. It should be noted that the LiST model does not capture potential synergies between specific interventions (e.g. the fact that the impact of behavior change communication interventions may be higher in populations that have access to affordable and diversified foods or in populations with higher levels of educational attainment). Therefore, it is possible that the impact estimates generated using LiST in fact underestimate the true impact of the interventions in some contexts.

n.a. = not applicable.

Among the set of proposed interventions, complementary feeding education, prophylactic zinc supplementation, and the public provision of complementary foods would be the most effective in preventing stunting, with each averting 44,000, 65,000, and 72,000 cases of stunting, respectively. Although the intermittent presumptive treatment of malaria in pregnancy would be the most cost-effective for preventing stunting, it would prevent fewer than 8,000 cases. Breastfeeding promotion by counseling mothers would be projected to increase the number of infants exclusively breastfed by 28,000, at a cost $88 per child exclusively breastfed, with a total additional financing need of $2.5 million over 10 years. For preventing anemia in women, staple food fortification would be the most cost-effective for non-pregnant women, at a cost of $10 for each case-year of anemia prevented. Over 10 years, staple food fortification and iron and folic acid supplementation for non-pregnant women would prevent about 391,000 and 859,000 case-years of anemia in women, respectively, and require $3.9 million and $16.3 million. Among pregnant women, antenatal micronutrient supplementation would prevent 264,000 case-years of anemia, at a cost of $37 per case-year prevented, or $9.9 million over 10 years.

Interventions to reduce stunting would require the most resources, accounting for over 80 percent of the total amount required for scale-up. However, some of the stunting interventions would also affect the breastfeeding and anemia targets. Figure 7.8 represents the distribution of total financing needs across interventions to address the four targets.

Figure 7.8: Ten-Year Financing Needs for Scaling Up a Package of Nutrition-Specific Interventions in Rwanda, by Percent per Intervention



Note: Some costs for anemia, breastfeeding, and stunting are shared across interventions. Costs for breastfeeding promotion ($2.5 million) have been included in both the total cost for the breastfeeding target and the total cost for the stunting target; the costs of intermittent presumptive treatment of malaria in pregnancy in malaria-endemic regions ($1.9 million) and antenatal micronutrient supplementation ($9.9 million) have been included in both the total cost for the anemia target and the total cost for the stunting target.

Two Alternative Investment Packages

In an environment of constrained resources in which Rwanda may not be able to raise $273 million over the next 10 years, two alternative investment packages are laid out for consideration.

The Priority Package: The first—the "priority package"—includes interventions that are the most cost-effective; that is, have the lowest cost per health outcome (e.g., case of stunting averted), and that have well-established global policy guidelines and delivery platforms. Based on those two criteria, the priority package includes antenatal micronutrient supplementation, infant and young child nutrition counseling, intermittent presumptive treatment of malaria in pregnancy in malaria-endemic regions, the treatment of severe acute malnutrition, weekly iron and folic acid supplementation for girls 15–19 years of age attending school, and fortification of

Table 7.4: Benefits and Cost-Effectiveness by Investment Package, Rwanda

GLOBAL TARGET	BENEFIT	PRIORITY PACKAGE	CATALYZING PROGRESS PACKAGE	FULL PACKAGE: All interventions needed to meet targets
		$5.7 million/year in financing need	**$12.2 million/year in financing need**	**$27.3 million/year in financing need**
STUNTING	Cases of stunting reduced by 2025 (vs 2015)[a]	39,000	75,000	183,000
ANEMIA	Cases of anemia in women prevented by 2025	754,000	955,000	1.5 million
BREASTFEEDING	Additional babies breastfed over 10 years	28,000	28,000	28,000
ALL TARGETS	**Child deaths averted over 10 years**	**2,400**	**3,600**	**6,200**
	Cost per death averted	23,034	33,409	44,059
	Cost per case of stunting averted	686	1,171	1,225

a. Total impacts of proposed intervention package combined with other health and poverty reduction efforts.

wheat and maize flour. These interventions would be scaled up to full program coverage in the first five years and maintained at full coverage levels for the last five years. This priority package would require an estimated $57 million over 10 years, or $5.7 million annually (see Table 7.4).

During the 10 years of scale up, this package would prevent more than 39,000 cases of stunting and avert 2,400 deaths in children under five years of age. It would also prevent more than 754,000 case-years of anemia in women and result in 28,000 children under six months of age being exclusively breastfed.

The Catalyzing Progress Package: The second alternative—the "catalyzing progress package"—includes scale-up of all interventions in the priority package, plus a phased approach to scaling up public provision of complementary foods, balanced energy protein supplementation, prophylactic zinc supplementation, and weekly iron and folic acid supplementation for women outside of schools. It is assumed that, for the latter set of interventions, during the first five years emphasis will be placed on establishing global guidelines and on operational research to develop effective delivery platforms, or to develop less expensive products or more cost-effective technologies. Financing needs are approximated as the cost of scaling up this set of interventions from 0 to 10 percent coverage only in the first five years. In the subsequent five years, it is assumed that the coverage expansion of those interventions will accelerate and reach 60 percent by 2025. This package would require $12.2 million per year, a total of $122 million over 10 years (Table 7.4). It would prevent 3,600 deaths and more than 75,000 cases of stunting among children under age five, increase the number of exclusively breastfed children under six months of age by 28,000, and prevent more than 955,000 case-years of anemia in women.

In comparing the relative cost-effectiveness of the three investment packages, the two alternative packages are more cost-effective in preventing deaths and stunting. However, neither is as effective as the full package in making progress toward achieving the stunting, wasting, and anemia targets. The priority and catalyzing progress packages would prevent 2,400 and 3,600 deaths respectively, compared with 6,200 deaths prevented

with the full package over 10 years. Under the full package scenario, 183,000 cases of childhood stunting would be prevented, compared with 75,000 cases under the catalyzing progress scenario and 39,000 cases under the priority package scenario. Furthermore, there would be nearly 750,000 and 545,000 more case-years of anemia prevented in women under the priority package and catalyzing progress package, respectively.

A Call to Action

As the world stands on the cusp of the new Sustainable Development Goals, there is an unprecedented opportunity to save children's lives, build future human capital and cognitive development, and drive faster economic growth. Scaling up key nutrition interventions during the critical 1,000 day window of early childhood would pay lifelong dividends, translating to healthier societies and more robust economies. If this window is missed, it is missed for life.

The additional financing needed to reach the global nutrition targets will require coordinated efforts by all stakeholders and a supportive policy environment. To achieve these targets, Rwanda would require an increase in the funding allocated to nutrition by $27.3 million annually, roughly equivalent to a 12 percent increase in current general government expenditure on health.[6] These investments are over and above those needed for improving water and sanitation and for addressing issues around women's empowerment and food security. Although this level of domestic financing is ambitious, Rwanda is already moving in this direction. In the long term, nutrition interventions have significant potential to reduce poverty and boost shared prosperity.

Accelerating the reduction of stunting in Rwanda will be essential for maximizing the return on investments in early childhood development, in education, and more broadly in policies aimed at fostering and enhancing human capital accumulation and job creation. Investing in the early years is even more critical because the Africa region is entering a demographic transition with an expected increase in the working-age population from 54 percent in 2010 to 64 percent in 2090. The scale-up of the key nutrition-specific interventions to reduce stunting is estimated to generate considerable returns in economic benefits over the productive lives of beneficiaries, and is a necessary condition to build human capital through investment in the early years and to harness the potential benefits of the demographic dividend.

Endnotes

Note: All dollar amounts are U.S. dollars unless otherwise indicated.

[1] Information about the Power of Nutrition initiative is available at https://ciff.org/grant-portfolio/the-power-of-nutrition/.

[2] ODA is committed from the Children's Investment Fund Foundation, USAID, the Embassy of the Kingdom of the Netherlands (EKN), UNICEF, the Government of the Netherlands, and the World Food Programme. Implementing partners include Catholic Relief Services, Caritas, UNICEF, and the World Food Programme.

[3] Current financing by source is from the Results for Development Institute and can be found at http://www.investinnutrition.org/.

[4] Note that because some funded interventions contribute to more than one target, the sum of funding across the four targets is less than the total funding for each target added together.

[5] Two of the global nutrition targets—those for low birthweight and for child overweight—were not included in the analyses because of insufficient data on the prevalence of low birthweight and a lack of consensus on effective interventions to reach the target for child overweight.

[6] The WHO National Health accounts database indicates that general government health expenditure in Rwanda was $227 million in 2014. At that level, this will need to be increased by 12% to accommodate the $27.3 million per year required for scale-up of the 11 nutrition-specific interventions.

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ANNEX 1: Income Elasticity Tables

Table A.1: Data Sources

Determinant	Category	Variable	Definition details	Source
Outcome	Chronic undernutrition	Stunting rate (%)	Prevalence of stunting, height for age (% of children under 5)	JME*
Basic	Macro-fiscal	Constant GNI per capita (USD)	Constant GNI per capita (USD)	WDI
		GNI per cap. growth (%)	GNI per capita growth (annual %)	WDI
		Economic recession episodes	Negative GNI per capita growth recorded in a year (calculated)	WDI
		Economic diversification (1=high ; 0=low)	Herfindhal index calculated over three sectors--value added agriculture, industry, and services (each expressed as % of GDP)	WDI
				WDI
		Public health exp. (% GDP)	General government health expenditure (GGHE) as % of GDP	WHO GHED
		Public health exp. (% GGE)	General government health expenditure (GGHE) as % of general government expenditure	WHO GHED
		Public education exp. (% GDP)	Government expenditure on education (% of GDP)	WDI
	Inclusiveness	GINI index	GINI index (World Bank estimate)	WDI
		Share bottom 40%	Income share held by bottom 40% of population	WDI
	Governance	Control of corruption	Control of corruption measured on a scale of -2.5 (weak) to 2.5 (strong)	WGI
		Government effectiveness	Government effectiveness measured on a scale of -2.5 (weak) to 2.5 (strong)	WGI
		Political stability	Political stability and absence of violence/terrorism measured on a scale of -2.5 (weak) to 2.5 (strong)	WGI
		Regulatory quality	Regulatory quality measured on a scale of -2.5 (weak) to 2.5 (strong)	WGI
		Rule of law	Rule of law measured on a scale of -2.5 (weak) to 2.5 (strong)	WGI
		Voice and accountability	Voice and accountability measured on a scale of -2.5 (weak) to 2.5 (strong)	WGI
	Conflicts	State fragility index	State Fragility Index (effectiveness score+legitimacy score=25 points max)	CSP
		Violence episodes	Total of magnitude scores of major international and civil politically violent episodes	CSP
		Number of conflicts (UCDP)	Number of conflicts (involving goverments) that occured this year with at least 25 deaths recorded	UCDP
Underlying	Food security	Food supply availability	Food availability as measured in kilocalories per capita per day	FAO
		Depth of food deficit	Food deficit as measured in kilocalories per capita per day	WDI
	Household environment	Improved sanitation	Improved sanitation facilities (% of population with access)	WDI
		Improved water source	Improved water source (% of population with access)	WDI

JME=Joint Malnutrition Estimates (UNICEF, WHO, The World Bank); WDI=World Development Indicators;
WHO GHED=World Health Organization Government Health Expenditure Database; WGI=Worldwide Governance Indicators;
CSP=Center for Systemic Peace; UCDP=Uppsala Conflict Data Program; FAO=United Nations Food and Agriculture Organization

* JME was prioritized for the stunting rate variable. However, when stunting data was missing for a year, these sources were used:
WDI, HealthStats (Health, Nutrition and Population Statistics), WHO, and DHS (Demographic and Health Surveys).

Table A.2: Descriptive Statistics

	MEAN (1)	MEAN NON-SSA (2)	MEAN SSA (3)	T-TEST: H0: (2) - (3) = 0	
				t-stat (4)	p-value (5)
Stunting rate (%)	30.1	25.8	38.7	-13.6	0.0
Constant GNI per capita (USD)	10791.3	13619.9	1860.8	45.1	0.0
Constant GDP per capita (PPP)	15077.7	18727.3	3965.9	39.8	0.0
GNI per cap. growth (%)	2.1	2.3	1.5	3.8	0.0
GDP per cap. growth (%)	2.1	2.4	1.3	5.9	0.0
Economic recession episodes	0.1	0.1	0.2	-13.8	0.0
Economic diversification (1=high ; 0=low)	0.5	0.5	0.4	30.6	0.0
Rents (% GDP)	9.5	8.4	12.3	-10.1	0.0
Agriculture sector (% GDP)	18.9	13.8	30.9	-41.0	0.0
Trade openned (X+M % GDP)	78.4	81.6	69.6	10.2	0.0
Public health exp. (% GDP)	3.7	4.2	2.4	26.6	0.0
Public health exp. (% GGE)	11.2	11.7	9.8	12.4	0.0
Public education exp. (% GDP)	4.4	4.4	4.4	0.7	0.5
GINI index	39.8	39.1	44.7	-7.7	0.0
Share bottom 40%	17.0	17.2	14.9	7.1	0.0
Female to male life expectancy ratio	1.1	1.1	1.1	25.8	0.0
Female having completed lower secondary education (%)	64.6	67.8	28.5	11.0	0.0
Control of corruption	0.0	0.2	-0.6	26.5	0.0
Government effectiveness	0.0	0.2	-0.8	32.8	0.0
Political stability	0.0	0.1	-0.6	17.8	0.0
Regulatory quality	0.0	0.2	-0.7	29.7	0.0
Rule of law	0.0	0.2	-0.7	30.0	0.0
Voice and accountability	0.0	0.2	-0.6	24.1	0.0
State fragility index	9.4	7.1	15.4	-41.1	0.0
Violence episodes	0.7	0.7	0.8	-2.0	0.0
# Conflicts (UCDP)	1.4	1.4	1.2	5.3	0.0
Food supply availability (kcal/cap/d)	2567.2	2694.5	2187.9	54.5	0.0
Depth of food deficit	137.8	111.2	188.6	-17.2	0.0
Coverage Vitamin A (% pop)	60.7	63.5	58.8	2.1	0.0
Open defecation (% pop)	12.9	6.8	31.1	-33.1	0.0
Improved sanitation (% pop)	69.5	81.5	30.8	70.5	0.0
Improved water source (% pop)	84.4	90.6	64.4	45.9	0.0

Table A.3: Summary of Existing Empirical Evidence

STUDY	INCOME ELASTICITY	INCOME VARIABLE	NUTRITIONAL OUTCOME VARIABLE	SAMPLE	ESTIMATION METHOD
Haddad et al. (2002)	-0.51 (long-run)	GDP per capita	Underweight prevalence	"1970-1995 61 countries"	OLS, country fixed effects
Headey (2013)	-0.18	% change in GDP per capita	Change in stunting rates (percentage points)	"1985-2009 115 countries"	"OLS, country fixed effects (first differences approach)"
Heltberg (2009)*	-0.2	% change in GDP per capita	Change in stunting rate (percentage points)	1969-2000	OLS (first differences approach)
Sahn (1994)	"-1.07 (urban bottom quintile) -0.28 (rural bottom quintile)"	% change in GNI per capita"	Height-for-age z-score	"1985-86, 1986-87 Côte d'Ivoire"	OLS
Smith & Haddad (2000)	-1.26	Log of per capita household expenditure	Underweight prevalence	"1970-1996 63 countries"	OLS, country fixed effects
Smith & Haddad (2002)	-0.63	GDP per capita	Underweight prevalence	"1970-1996 63 countries"	OLS, random effects
Smith & Haddad (2015)	"-0.63 (long-run) -0.17 (short-run)"	GDP per capita	Stunting prevalence	"1970-2012 116 countries"	"Long-run: 2SLS/IV, country fixed effects; Short-run: OLS, first differences"
Webb & Block (2010)	-0.32	GDP per capita	Stunting prevalence	"1980-2007 29 countries"	OLS

Table A.4: Regression Results (Pooled OLS and IV-2SLS)

DEPENDENT: LN(STUNTING)	POOLED OLS (1)	POOLED OLS (2)	IV-2SLS (3)	POOLED OLS (4)	POOLED OLS (5)
GDP per cap. (Ln)	-0.504*** (0.0158)	-0.500*** (0.0159)	-0.463*** (0.0406)	-0.566*** (0.0192)	-0.568*** (0.0192)
Interaction GDP*SSA				0.377*** (0.0314)	
Interaction GDP*South SSA					0.476*** (0.0316)
Interaction GDP*West SSA					0.419*** (0.0484)
Interaction GDP*Central SSA					0.445*** (0.0335)
Interaction GDP*East SSA					0.328*** (0.0363)
Sub-Saharan Africa				-2.560*** (0.215)	
Southern SSA					-3.268*** (0.248)
Western SSA					-2.935*** (0.320)
Central SSA					-2.954*** (0.230)
Eastern SSA					-2.152*** (0.236)
Constant	6.982*** (0.109)	7.034*** (0.109)	6.786*** (0.299)	7.549*** (0.141)	7.566*** (0.141)
INCOME ELASTICITIES					
Non-SSA	. .	. .	. .	-0.566*** (0.0192)	-0.568*** (0.0192)
SSA	. .	. .	. .	-.189*** (.025)	. .
South SSA	. .	. .	. .	. .	-.092*** (.025)
West SSA	. .	. .	. .	. .	-.149*** (.045)
Central SSA	. .	. .	. .	. .	-.123*** (.028)
East SSA	. .	. .	. .	. .	-.24*** (.031)
ENDOGENEITY TESTS					
Sargan-Hansen J-stat. p-value	. .	. .	.639 .424	:	:
KP LM-stat p-value	. .	. .	94.639 0	:	:
KP F-stat KP F-critical value 10%	. .	. .	36.479 19.93	:	:
Wu-Hausman F-test p-value	. .	. .	.295 .587	:	:
Durbin Wu-Hausman Chi2-test p-value	. .	. .	.296 .586	:	:
Observations	808	808	728	808	808
R-squared	0.607	0.617	0.617	0.662	0.672
Time trend	NO	YES	YES	YES	YES

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Instrumental variables for income include M2 as % of GDP, and the investment share of the economy

Table A.5: Panel Regression Results (Random/Fixed/Mixed Effects)

DEPENDENT: LN(STUNTING)	PANEL REGRESSION MODELS					
	RANDOM EFFECTS		FIXED EFFECTS		MIXED EFFECTS	
	(1)	(2)	(3)	(4)	(5)	(6)
GDP per cap. (Ln)	-0.552*** (0.0319)	-0.549*** (0.0319)	-0.498*** (0.0458)	-0.489*** (0.0460)	-0.546*** (0.0309)	-0.544*** (0.0305)
Interaction GDP*SSA	0.348*** (0.0550)		0.318*** (0.0694)		0.341*** (0.0529)	
Interaction GDP*South SSA		0.490*** (0.133)		0.465*** (0.155)		0.483*** (0.128)
Interaction GDP*West SSA		0.314*** (0.0976)		0.253** (0.108)		0.313*** (0.0958)
Interaction GDP*Central SSA		0.371*** (0.110)		0.287* (0.146)		0.373*** (0.102)
Interaction GDP*East SSA		0.323*** (0.106)		0.296** (0.117)		0.313*** (0.104)
Sub-Saharan Africa	-2.256*** (0.413)				-2.230*** (0.464)	
Southern SSA		-3.268*** (1.076)				-3.319*** (1.042)
Western SSA		-2.115*** (0.673)				-2.213*** (0.677)
Central SSA		-2.286*** (0.874)				-2.410*** (0.829)
Eastern SSA		-1.988*** (0.701)				-2.037*** (0.706)
Constant	7.335*** (0.264)	7.307*** (0.264)	6.305*** (0.294)	6.293*** (0.299)	7.314*** (0.273)	7.317*** (0.268)
INCOME ELASTICITIES						
Non-SSA	-0.552*** (0.0319)	-0.549*** (0.0319)	-0.498*** (0.0458)	-0.489*** (0.0460)	-0.546*** (0.0309)	-0.544*** (0.0305)
SSA	-.204*** (.048)	. .	-.181*** (.061)	. .	-.205*** (.046)	. .
South SSA	. .	-.058 (.131)	. .	-.024 (.152)	. .	-.062 (.126)
West SSA	. .	-.235 (.093)	. .	-.236** (.1)	. .	-.232** (.092)
Central SSA	. .	-.177 (.106)	. .	-.201 (.141)	. .	-.171* (.098)
East SSA	. .	-.226*** (.105)	. .	-.193* (.116)	. .	-.232** (.102)
Observations	808	808	808	808	808	808
Sargan-Hansen statistic	2.961	3.646	.	.	.	.
p-value	.398	.724	.	.	.	.
Time Trend	YES	YES	YES	YES	YES	YES
R-squared	.	.	.461	.46	.	.

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table A.6: Quantile Regression Results

DEPENDENT: LN(STUNTING)	QUANTILE REGRESSION MODELS					
	25th percentile		50th percentile		75th percentile	
	(1)	(2)	(3)	(4)	(5)	(6)
GNI per cap. (Ln)	-0.662*** (0.0303)	-0.666*** (0.0290)	-0.540*** (0.0185)	-0.542*** (0.0180)	-0.418*** (0.0165)	-0.428*** (0.0158)
Interaction GNI*SSA	0.446*** (0.0649)		0.368*** (0.0396)		0.263*** (0.0354)	
Interaction GNI*South SSA		0.558*** (0.157)		0.441*** (0.0977)		0.359*** (0.0858)
Interaction GNI*West SSA		0.459*** (0.144)		0.401*** (0.0896)		0.330*** (0.0787)
Interaction GNI*Central SSA		0.472*** (0.120)		0.377*** (0.0743)		0.357*** (0.0653)
Interaction GNI*East SSA		0.399** (0.164)		0.264*** (0.102)		0.200** (0.0892)
Sub-Saharan Africa	-2.969*** (0.460)		-2.520*** (0.281)		-1.830*** (0.251)	
Southern SSA		-3.694*** (1.220)		-3.075*** (0.758)		-2.643*** (0.665)
Western SSA		-3.177*** (0.966)		-2.839*** (0.600)		-2.374*** (0.526)
Central SSA		-3.082*** (0.904)		-2.560*** (0.561)		-2.467*** (0.493)
Eastern SSA		-2.547** (1.042)		-1.793*** (0.647)		-1.405** (0.568)
Constant	8.013*** (0.244)	8.055*** (0.234)	7.404*** (0.149)	7.423*** (0.145)	6.756*** (0.133)	6.815*** (0.128)
INCOME ELASTICITIES						
Non-SSA	-0.662*** (0.0303)	-0.666*** (0.0290)	-0.540*** (0.0185)	-0.542*** (0.0180)	-0.418*** (0.0165)	-0.428*** (0.0158)
SSA	-.216*** (.058)	. .	-.172*** (.035)	. .	-.155*** (.031)	. .
South SSA	. .	-.108 (.155)	. .	-.101 (.096)	. .	-.07 (.084)
West SSA	. .	-.208 (.142)	. .	-.141 (.088)	. .	-.098 (.077)
Central SSA	. .	-.195* (.116)	. .	-.165** (.072)	. .	-.072 (.063)
East SSA	. .	-.268* (.161)	. .	-.278*** (.1)	. .	-.228*** (.088)
Observations	808	808	808	808	808	808
Time trend	YES	YES	YES	YES	YES	YES

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table A.7a: Mixed Effects Regression Results

DEPENDENT: LN(STUNTING)	MULTILEVEL MIXED-EFFECTS MODEL							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
GDP per cap. (Ln)	-0.546*** (0.031)	-0.546*** (0.034)	-0.552*** (0.032)	-0.514*** (0.047)	-0.564*** (0.045)	-0.545*** (0.031)	-0.514*** (0.036)	-0.419*** (0.039)
Interaction GDP*SSA	0.341*** (0.053)	0.323*** (0.059)	0.345*** (0.055)	0.265*** (0.083)	0.334*** (0.076)	0.334*** (0.053)	0.369*** (0.061)	0.266*** (0.055)
Sub-Saharan Africa	-2.230*** (0.464)	-2.179*** (0.496)	-2.264*** (0.477)	-1.674*** (0.623)	-2.180*** (0.581)	-2.204*** (0.455)	-2.444*** (0.499)	-1.822*** (0.448)
Past economic recession (GNI pc growth<0)		0.029 (0.023)						
Diversification of GDP (1-Herfindhal)		-1.018*** (0.278)						
Trade (% of GDP)			0.000 (0.000)					
Lagged public health exp. (%GDP)				-0.034* (0.019)				
Lagged public education exp. (%GDP)				-0.029* (0.016)				
GINI coefficient					0.002 (0.003)			
Female/Male life expectancy ratio						-0.883 (0.551)		
(Ln) Food supply (kcal/capita/day) (FAO)							-0.422** (0.165)	
People practicing open defecation (% of population)								-0.002 (0.002)
Improved sanitation facilities (% of population with access)								-0.007*** (0.002)
Improved water source (% of population with access)								-0.001 (0.002)
Constant	7.314*** (0.273)	7.776*** (0.292)	7.358*** (0.278)	7.305*** (0.383)	7.379*** (0.383)	8.258*** (0.645)	10.374*** (1.177)	6.923*** (0.306)
INCOME ELASTICITIES								
Non-SSA	-0.546*** (0.031)	-0.546*** (0.034)	-0.552*** (0.032)	-0.514*** (0.047)	-0.564*** (0.045)	-0.545*** (0.031)	-0.514*** (0.036)	-0.419*** (0.039)
SSA	-.205*** (.046)	-.224*** (.053)	-.207*** (.048)	-.249*** (.071)	-.249*** (.071)	-.249*** (.071)	-.249*** (.071)	-.249*** (.071)
RANDOM-EFFECTS PARAMETERS								
Standard deviation (region effect) y	.222*** (.077)	.22*** (.077)	.22*** (.077)	.127*** (.073)	.183*** (.072)	.204*** (.074)	.202*** (.072)	.178*** (.074)
Standard deviation (country effect) τ	.457*** (.03)	.457*** (.031)	.458*** (.03)	.42*** (.034)	.394*** (.032)	.458*** (.03)	.432*** (.03)	.434*** (.03)
Standard deviation (residual) ε	.215*** (.006)	.211*** (.006)	.216*** (.006)	.183*** (.01)	.212*** (.008)	.214*** (.006)	.214*** (.006)	.19*** (.006)
Observations	808	738	779	289	476	806	717	690
Time trend	YES	YES	YES	YES	YES	YES	YES	YES

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table A.7b: Mixed Effects Regression Results (continued)

DEPENDENT: LN(STUNTING)	MULTILEVEL MIXED-EFFECTS MODEL								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
GDP per cap. (Ln)	-0.546***	-0.448***	-0.432***	-0.493***	-0.467***	-0.444***	-0.477***	-0.564***	-0.483***
	(0.031)	(0.041)	(0.043)	(0.040)	(0.041)	(0.041)	(0.038)	(0.030)	(0.050)
Interaction GDP*SSA	0.341***	0.272***	0.262***	0.285***	0.280***	0.276***	0.338***	0.385***	0.327***
	(0.053)	(0.063)	(0.063)	(0.064)	(0.064)	(0.063)	(0.056)	(0.051)	(0.084)
Sub-Saharan Africa	-2.230***	-1.643***	-1.586***	-1.758***	-1.709***	-1.687***	-2.164***	-2.541***	-2.049***
	(0.464)	(0.529)	(0.531)	(0.526)	(0.527)	(0.528)	(0.472)	(0.453)	(0.649)
Control of corruption		-0.103***							
		(0.038)							
Government effectiveness			-0.127***						
			(0.045)						
Political stability and absence of violence				0.005					
				(0.024)					
Regulatory quality					-0.053				
					(0.037)				
Rule of law						-0.123***			
						(0.041)			
State fragility index							0.011**		
							(0.006)		
Political violence episodes								0.000	
								(0.007)	
Number of conflicts									-0.033
									(0.023)
Constant	7.314***	6.613***	6.479***	6.986***	6.767***	6.556***	6.704***	7.480***	6.924***
	(0.273)	(0.345)	(0.363)	(0.334)	(0.349)	(0.349)	(0.349)	(0.265)	(0.416)
INCOME ELASTICITIES									
Non-SSA	-0.546***	-0.448***	-0.432***	-0.493***	-0.467***	-0.444***	-0.477***	-0.564***	-0.483***
	(0.031)	(0.041)	(0.043)	(0.040)	(0.041)	(0.041)	(0.038)	(0.030)	(0.050)
SSA	-.205***	-.177***	-.17***	-.208***	-.187***	-.168***	-.139***	-.179***	-.156*
	(.046)	(.055)	(.056)	(.057)	(.057)	(.056)	(.051)	(.044)	(.081)
RANDOM-EFFECTS PARAMETERS									
Standard deviation (region effect) y	.222***	.222***	.222***	.204***	.208***	.227***	.205***	.228***	.267***
	(.077)	(.08)	(.081)	(.079)	(.079)	(.081)	(.073)	(.074)	(.114)
Standard deviation (country effect) τ	.457***	.441***	.443***	.458***	.453***	.437***	.41***	.402***	.357***
	(.03)	(.03)	(.03)	(.031)	(.031)	(.03)	(.03)	(.027)	(.044)
Standard deviation (residual) σ	.215***	.187***	.187***	.187***	.187***	.188***	.185***	.209***	.145***
	(.006)	(.007)	(.007)	(.007)	(.007)	(.007)	(.006)	(.006)	(.01)
Observations	808	526	525	525	525	526	593	777	168
Time trend	YES	YES	YES	YES	YES	YES	YES	YES	YES

Standard errors in parentheses
**** p<0.01, ** p<0.05, * p<0.1*

ANNEX 2: Brief Review of Empirical Evidence of the Determinants of Undernutrition

To better understand the drivers of child undernutrition, past studies have conducted cross-country regressions and/or run analyses on country-level data.

Immediate Causes

Because of the lack of child-level data on dietary intake and health status (two immediate determinants), the econometric analyses have focused on the underlying and basic determinants as defined in UNICEF's conceptual framework on the factors determining child nutritional status.

Underlying Causes

The main underlying determinants considered in past studies of child undernutrition include the following: food security, resources for/knowledge of the caregiver, and resources in the household environment.

Food Security

National food supply is the main variable used in this category of underlying causes since the indicator is readily available. The literature calls for better measurement of food security since national food availability does not encompass food access/distribution or intake. Meanwhile, studies continue to use food availability to identify a "food secure" country without considering differences between regions, communities, households, and within households. Dietary energy availability/food supply (Frongillo, de Onis, and Hanson 1997; Smith and Haddad 2000, 2002, 2015) and food production per capita (Headey 2012) are measures employed by previous studies; these variables are shown to have significant positive effects on nutritional outcomes.

Resources for/Knowledge of the Caregiver

The most common measure of adequacy/quality of care for a child is female/mother's education or literacy rate. A couple of micro-level studies use the number of adult women in the household: (Sahn 1994) with data from Côte d'Ivoire and (Marini and Gragnolati 2003) with data from Guatemala.

Both cross-country and country-level results point to the importance of female education/literacy to reduce stunting prevalence (Christiaensen and Alderman 2001; Delpeuch et al. 2000; Frongillo, de Onis, and Hanson 1997; Headey 2012; Kabubo-Mariara, Ndenge, and Kirii 2006; Milman et al. 2005; Marini and Gragnolati 2003; Sahn 1994; Smith and Haddad 2000, 2002, 2015). This variable has the most consistent results; more education for the caregiver will always result in better nutritional outcomes for children.

Enabling Environment Resources

This underlying determinant encompasses improved sanitation, improved water sources, and health care access for households. Safe water has been found to be a significant driver of stunting reduction (Christiaensen and Alderman 2001; Milman, et al. 2005; Marini and Gragnolati 2003; Smith and Haddad 2000, 2002, 2015). However, household infrastructure variables, such as safe water, have not been consistently significant across studies. For example, Headey (2012) found that improved sanitation, improved water, and electricity had no effect on nutritional outcomes (Headey 2012). Likewise, Brown et al. (2017) found no significant effect from improved sanitation and water (Brown, Ravallion, and van de Walle 2017).

A key determinant belonging to this category, health care access, is generally not included in cross-country studies because of the lack of quality data. Thus, infrastructure quality variables—easily available and universally recorded in household surveys—are relied upon to evaluate the local environment/community resources. Only Headey (2012) decided to include two variables that proxy for health care access: percentage of births in a medical facility and percentage of children vaccinated (Headey 2012). Country-level studies, however, may have adequate data to assess whether access to health care significantly contributes to child nutrition. Glewwe et al. (2004) use data from Vietnam and show that distance to the nearest medical facility and the availability of oral rehydration salts are significant factors that reduce stunting (Glewwe, Koch, and Nguyen 2004).

Basic Causes

Following the conceptual framework, the basic determinants fall into five main categories: income, other macro-fiscal, inclusiveness, governance, and conflict.

Income

Most cross-country studies on the drivers of nutritional outcomes use GDP per capita as the main income variable; only Heltberg uses change in GNI per capita as the main independent variable (Heltberg 2002, 2009). There seems to be a general consensus that increases in income have a positive influence on stunting rates, but also that growth-promoting policies should be complemented with direct health-related interventions.

Overall, income per capita has a significant effect on nutritional status of children (Alderman et al. 2001; Headey 2012; Heltberg 2009; Smith and Haddad 2000, 2002, 2015). The brief spotlight on Sub-Saharan Africa in Smith & Haddad (2000), in contrast, concluded that, because of declining national income in the region between 1975 and 1990, national income did not have a positive influence on undernutrition reduction (Smith and Haddad 2000). Heltberg's 2009 study had a region-by-region analysis that concluded that there indeed was a small but significant effect of income per capita on stunting rates across all regions, including Sub-Saharan Africa, although no formal statistical test was provided to assess whether the income elasticity in Sub-Saharan Africa was different than in other regions of the world (Heltberg 2009).

Income composition has also been considered in past cross-country studies with mixed results. Webb and Block (2012) suggest that increasing agricultural income per capita would directly improve nutritional outcomes (Webb and Block 2012). However, Headey (2012) found the opposite effect: non-agricultural growth (measured as a percentage change of GDP per capita) had a significant effect on reducing stunting (Headey 2012).

A significant income effect on improving stunting rates has further been found in micro level studies. These country-level analyses use household consumption/expenditure per capita (or per adult equivalent) or an asset index. They support the general findings from cross-country regressions that increasing income per capita at the household-level improves child nutritional outcomes. Table A2.1 identifies these micro-level papers and their countries of study.

It is important to note that a few studies found a minimal or no significant association between income and child nutrition. Using Demographic and Health Survey data from 36 countries and income data from the Penn World Tables, Vollmer et al. (2014) found a very small association between income and nutritional outcomes (Vollmer, et al. 2014). Additionally, two country-level studies did not find a significant effect: (1) Subramanyam et al. (2011) found no association between state-level economic growth and undernutrition in India

(Subramanyam, et al. 2011); and (2) Glewwe et al. (2004) found no significant effect of household per capita expenditures on nutrition in Vietnam (Glewwe, Koch, and Nguyen 2004).

Economic diversification is also an uncommon variable in these cross-country studies. One study (Milman et al. 2005) concluded that countries with a more economically diverse economy improved stunting rates more than countries with economies concentrated in agriculture. This variable may play an important role when looking at subregions of Sub-Saharan Africa where subsistence agriculture dominates many local economies or in countries where GDP growth is mostly driven by natural resource rents. Lack of economic diversification, especially if GDP is concentrated in primary commodities or in extractive industries, is also often associated with higher macroeconomic volatility, which in turn may have a detrimental incidence on stunting reduction for a given level of economic growth.

No studies reviewed included the following variables: economic recession, economic rents, or government expenditure on education.

Inclusiveness

The GINI index was used in a few studies to control for economic inequality within a country: (Haddad, et al. 2002; Heltberg 2009; and Tiwari, Zaman, and Saavedra 2013). Only Milman et al. (2005) controlled for countries' income distribution—that is, the share of income held by the richest 20 percent of the population. Once income distribution was controlled for in this study, the significance of GNI per capita on stunting disappeared (Milman et al. 2005).

Governance

Governance variables in past studies have had different effects, depending on the source and type of variable used. Milman et al. 2005 shows that democracy—a measure of civil liberties and political rights—is not a significant factor affecting child undernutrition, whereas Smith and Haddad (2000, 2002) demonstrate that a democracy index positively influences almost all the variables included in their study (Milman, et al. 2005; Smith and Haddad 2000, 2002). Smith and Haddad (2015) note that the regression results are sensitive to the type of governance indicator used: when they used Worldwide Governance Indicators (WGI), they found no impact from governance on nutritional outcomes; however, when they employed governance indicators published by the Political Risk Services Group (International Country Risk Guide indicators), they found a significant impact on the stunting rate. As a side note, this significant effect did not hold in the short run (Smith and Haddad 2015).

Conflict

Variables on political violence have not been statistically significant, as shown in one study. Milman et al. (2005) found no significant effect with using conflict variables from Polity IV country reports 2003 and the State Failure Problem Set 1955-2001 (Milman et al. 2005). The analysis undertaken in this section of the report employs three novel variables concerned with conflict: the state fragility index, the frequency of violent conflicts involving governments, and the magnitude score of politically violent episodes (see Table 1).

Endnotes

Note: All dollar amounts are U.S. dollars unless otherwise indicated.

[1] Information about WGI can be found at http://info.worldbank.org/governance/wgi/.

ANNEX 3: Levels of Malnutrition and World Bank Investments, by Selected Countries

COUNTRY	PERCENTAGE OF CHILDREN UNDER 5 YEARS OF AGE (%) [1]					ANEMIC – PERCENTAGE OF WOMEN 15-49 YEARS OLD[2]	WORLD BANK GROUP INVESTMENTS BY GLOBAL PRACTICE (nutrition and food security themed projects/components) (US $millions)[3]				
	STUNTED[4]	UNDERWEIGHT	WASTED	VITAMIN A DEFICIENT	ANEMIC		HEALTH NUTRITION AND POPULATION	AGRI-CULTURE	SOCIAL PROTECTION	EDUCATION	TOTAL
ANGOLA	37.6	19.0	4.9	64.3	53.3	47.3					0.0
BENIN	34.0	18.0	4.5	-	58.3	51.5	22.0	1.5			23.5
BURKINA FASO	27.3	19.2	7.6	-	86.1	50.5			5.0		5.0
CAMEROON	31.7	14.8	5.2	38.8	60.3	41.7	10.0		10.0		20.0
CENTRAL AFRICAN REPUBLIC	40.7	23.5	7.4	68.2	-	46.2					0.0
CONGO	32.1	16.9	11.1	-	66.7	53.8					0.0
COTE D'IVOIRE	29.6	15.7	7.6	-	74.8	51.8	57.0	2.7			59.7
DEMOCRATIC REPUBLIC OF CONGO	42.6	23.4	8.1	61.1	59.8	44.7	23.0				23.0
ERITREA	50.3	38.8	15.3	-	-	36.9					0.0
ETHIOPIA	38.4	23.6	9.9	-	44.2	21.7	179.8	35.0	210.0		422.8
GAMBIA	17.5	6.5	3.4	64.0	72.8	57.2	10.8				10.8
GHANA	18.8	11.0	4.7	-	65.7	48.6	16.6				16.6
KENYA	26.0	11.0	4.0	84.4	36.3	27.5	26.2				26.2
LESOTHO	33.2	10.3	2.8	78.0	50.8	27.2					0.0
MADAGASCAR	49.2	36.8	15.2	42.1	45.3	36.6	55.8				55.8
MALAWI	42.4	16.7	3.8	59.2	62.6	32.3	138.7				138.7
MALI	38.5	27.9	15.3	-	85.4	54.8			7.0		7.00
MAURITANIA	27.9	24.9	14.8	-	-	37.2					0.0
MOZAMBIQUE	43.1	15.6	6.1	68.8	68.7	49.9	49.6			16	65.6
NIGER	23.0	5.7	1.5	-	73.4	49.2	20.6	1.8	3.2	6.7	32.4
NIGERIA	32.9	19.4	7.2	29.5	68.4	49.9	720.0				720.0
RWANDA	37.9	9.3	2.2	6.4	36.5	19.4	25.0		5.0		30.0
SENEGAL	20.5	15.5	7.8	-	60.3	53.5	35.8		8.1	60	103.9
SUDAN	14.7	26.3	21.4	-	-	29.4					0.0
TANZANIA	26.8	13.3	9.9	24.2	57.7	38.6	30.0				30.0
UGANDA	34.2	12	4.3	27.9	52.8	29.6	3.0	27.6			30.6
ZAMBIA	40.0	14.8	6.3	54.1	-	31.2	13.2				13.2
ZIMBABWE	27.6	11.2	3.3	35.8	36.8	30.1					0.0

Note: - indicates data not available.

1 Stunting, wasting, and underweight prevalence data from the 2017 version of the Joint Malnutrition Estimates; prevalence of vitamin A deficiency data were extracted from country profiles available through the WHO's Nutrition Landscape Information System (NLiS), with country data being collected between 1993 and 2003; anemia prevalence data were retrieved from statcompiler.com and sourced from the most recent Demographic and Health Surveys (DHS) or Malaria Indicator Surveys (MIS).

2 Data for prevalence of anemia in women of reproductive age were retrieved from the WHO Global Targets Tracking Tool.

3 Data on active and pipeline World Bank Group investments as of September 1, 2017, and include operations with nutrition and food security theme. Project appraisal documents, project information documents, and project papers were reviewed to extract committed or proposed amounts to be dedicated to nutrition and food security theme (detailed on next page).

4 Cutoffs >40% 30-40% 20-30% <20%

Notes on current and planned World Bank Group nutrition and food security investments by country:

ANGOLA	None
BENIN	75% of $28M project - Benin Multisectoral Food Health Nutrition Project (P143652) FY2014; 60% of $2.48M project - Nutrition Sensitive Agriculture & Capacity Building of Small & Marginal Farmers Project (P155822) FY 2016; $45M additional financing project (Agricultural Productivity and Diversification Additional Financing (P160029) FY 2017) has clear nutrition component but unclear how much is dedicated to this so not included in total.
BURKINA FASO	10% of $50M project - Social Safety Net Project (P124015) FY 2014
CAMEROON	10% of $100M project - Health System Performance Reinforcement Project (P156679) FY 2016; 20% of $50M project - Cameroon Social Safety Nets (P128534) FY 2013
CENTRAL AFRICAN REPUBLIC	None
CONGO	None
COTE D'IVOIRE	$50M Multisectoral nutrition project FY 2018 (pipeline); 20% of $35M project - Health Systems Strengthening and Ebola Preparedness Project (P147740) FY 2015; $2.7M project – Support to Nutrition-sensitive Agriculture and Capacity Development of Small and Marginal Farmers (P155081) FY 2018
DEMOCRATIC REPUBLIC OF CONGO	10% of $230M project - Health System Strengthening for Better Maternal and Child Health. Results Project (PDSS) (P147555) FY 2015
ERITREA	None
ETHIOPIA	$2.75M Promoting young women's livelihoods and nutrition project (P157716) FY 2017; 10% of $350M IDA to Second Agricultural Growth Project (P148591) FY 2015; 10% of $600M project - ET Productive Safety Nets Project 4 (PSNP 4) (P146883) FY 2015; $175M of $700M project across 4 sectors – Enhancing Shared Prosperity Through Equitable Services (P161373) FY 2018; 25% of $600M project – Ethiopia Rural Safety Net Project (P163438) FY 2018
GAMBIA	35% of $3.68M on project Maternal and Child Nutrition and Health Results Project (P143650) FY 2014; 40% of $5M additional financing on project GM Maternal and Child Nutrition and Health Results Project (P154007) FY 2015; $7.5M additional financing - AF Maternal and Child Nutrition and Health Results Project (P159693) FY 2017
GHANA	20% of $68M project - Ghana - Maternal, Child Health and Nutrition Project (P145792) FY 2014; $3M Improved Feeding Practices for first 1,000 Days (P159735) FY 2018
KENYA	10% of $150M project - Transforming Health Systems for Universal Care (P152394) FY 2016; 20% of $56.8M project - Health Sector Support Additional Financing (P128663) FY 2012
LESOTHO	None
MADAGASCAR	15% of $65M - Madagascar Emergency Support to Critical Education, Health and Nutrition Services Project (P131945) FY 2013; 60% of $10M additional financing - Madagascar Emergency Support to Critical Education, Health and Nutrition Services Project (P131945); $40M project - Madagascar: An Integrated Approach to Improving Nutrition Outcomes (P160848) FY 2018
MALAWI	30% of $80M project - Malawi Nutrition and HIV/AIDS Project (P125237) FY 2012; $12.27M of $22.6M additional financing - Additional Financing to Nutrition and HIV/AIDS Project (P156129) FY 2016; $100M project – Investing in the Early Years for Growth and Productivity in Malawi (P164771) FY 2019
MALI	10% of $70M project - Emergency Safety Nets project (Jigiséméjiri) (P127328) FY 2013
MAURITANIA	None
MOZAMBIQUE	80% of $37M - Mozambique Nutrition Additional Financing (P125477) FY 2013; 40% of $40M project - MZ- AF to Education Sector Support Project (P124729) FY 2012; Mozambique Primary Health Care Strengthening Project (P160967) FY 2018
NIGER	20% of $103M project - Population and Health Support Project (P147638) FY 2015; 70% of $2.5M project - Nutrition-Sensitive Agriculture and Capacity Building of Small and Marginal Farmers (P156863) FY 2016; 15% of $22.5M project - Adaptive Social Safety Nets Project (P155846) FY 2016; 8% of $84.2M project - Niger - GPE - Support to Quality Education Project (P132405) FY 2015
NIGERIA	40% of $50M project - Second Additional Financing to Third National Fadama Development Proj (P158535) FY 2016; $350M project - Accelerating Nutrition Results in Nigeria (P162069) FY 2018; $500M project - Nigeria - Program to Support Saving One Million Lives (P146583) FY 2015 - has significant nutrition component but unclear how much is allocated so not included in total; $350M project - Accelerating Nutrition results in Nigeria (P162069) FY 2018

RWANDA	$80M project - Strengthening Social Protection - Rwanda(P162646) FY 2018 - This is combined allocation to component with nutrition and ECD activities; $25M project – Rwanda Stunting Prevention and Reduction Project (P164845) FY 2018
SENEGAL	60% of $3M project - Building Resilience to Food and Nutrition Insecurity Shocks (P155475) FY 2017; 20% of $20M project - Senegal Health & Nutrition Financing (P129472) FY 2014; 20% of $40.5M project - Building Resilience to Food and Nutrition Insecurity Shocks (P155475) FY 2014; $30M project – Investing in Maternal and Child Health project (P162042) FY 2018; $60M project - Investing in the early years for human development in Senegal (P161322) FY 2018
SUDAN	None
TANZANIA	15% of $200M project - Strengthening Primary Health Care for Results (P152736) FY 2015
UGANDA	$3M project - An Innovative, Integrated Approach to Enhance Smallholder Family Nutrition (P143324) FY 2013; $27.64M project - Uganda Multisectoral Food Security and Nutrition Project (P149286) FY 2015
ZAMBIA	$2.75M project - Zambia Livelihood and Nutrition Project (P147745) FY 2015; 20% of $52M project - Health Services Improvement Project (P145335) FY 2014
ZIMBABWE	None


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