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The Nutrition Challenge in Sub-Saharan Africa

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Abstract: Sub-Saharan Africa is home to some of the most nutritionally insecure people in the world. Poor infrastructure and limited resources compounded with conflict, HIV, and poor access to health services are factors that contribute to the staggering levels of malnutrition and food insecurity on the continent. Despite these enormous challenges, some countries in Africa are making progress towards food and nutrition security and there has never been a better time to work towards improved human development that has nutrition as a goal.

Keywords: Nutrition security, stunting, micronutrient deficiencies, 1000 days

JEL Classification: 1 - Health; I10 - General

1. The Food and Nutrition Security Situation in Africa: A Landscape Analysis

Africa: A land of promise with great nutrition challenges

The continent of Africa with its 52 countries is one with incredible opportunities in the face of many challenges. The land itself is diverse topographically, with a large representation of agroecological climates and food diversity of over 150 food crops of which 115 are indigenous [4] that make Africa distinctive. The population, an estimated 800 million with the youngest population bulge, has quadrupled in the last 50 years with a low life expectancy of below 50 years of age in many countries and unacceptable rates of maternal and child mortality. Furthermore, Africa has seen income disparity increase further in the last decades which directly impacts those who are food insecure and hungry.

Sub-Saharan Africa is home to some of the most nutritionally insecure people in the world. Poor infrastructure and limited resources compounded with conflict, HIV, and poor access to health services are factors that contribute to the staggering levels of malnutrition and food insecurity on the continent. Despite these enormous challenges, some countries in Africa are making progress towards food and nutrition security and there has never been a better time to work towards improved human development that has nutrition as a goal.

The definition of *food security* set out at the 1996 World Food Summit stated that *"food security exists when all people at all times have both physical and economic access to sufficient food to meet their dietary needs for a productive and healthy life"* [10] [12]. The achievement of food security depends upon four distinct but interrelated processes. The first is *food availability,* which refers to ensuring sufficient quantity and diversity of food is available for consumption from the farm, the marketplace or elsewhere. Second, *food access* refers to households having the physical and financial resources required to obtain these foods as well as not suffering limits to their access deriving from customs or traditions. Third and key to nutrition is *food utilization,* which implies the capacity and resources necessary to use and store food appropriately to support healthy diets. The primary factor influencing utilization is individual health status. This might include access to potable drinking water and adequate sanitation, knowledge of food preparation and the basic principles of good nutrition, and proper child care and illness management [10]. The fourth and final process is *food stability* and the ability to cope with shocks and vulnerabilities both in the short term as well as in the long term.

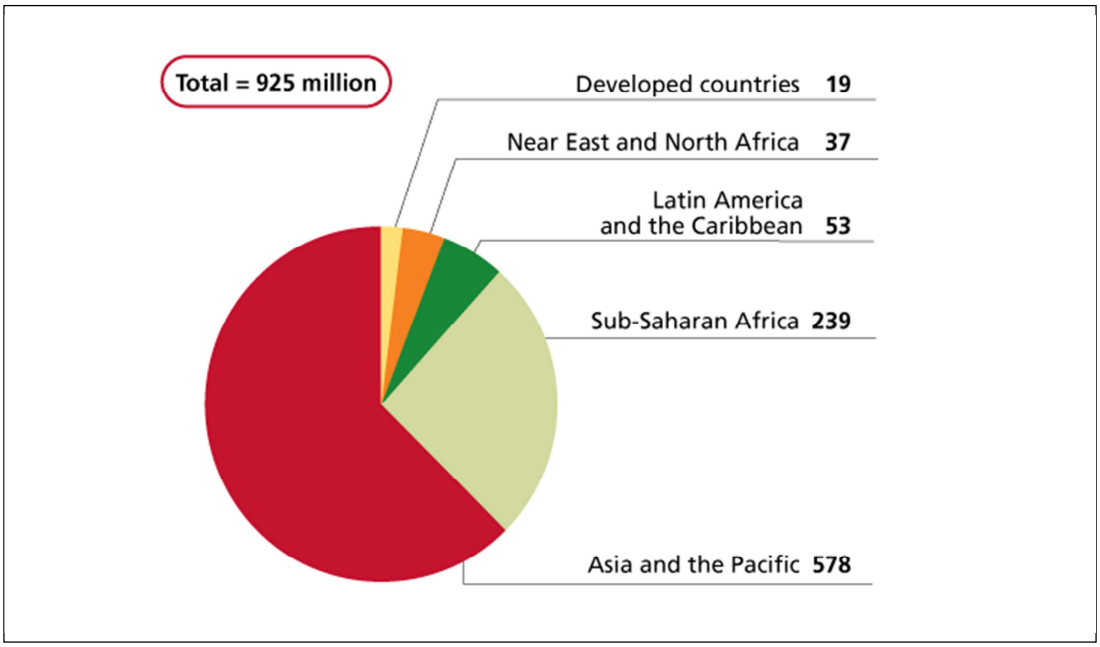
For many years, food security was simply equated with enhancing the availability of food, and was linked to innovations in agricultural production. While food availability is clearly important to achieving food security, having the means to effectively access and utilize quality food remains central to good nutrition [17]. The issue of access to high quality nutritious foods has become a major challenge for many individuals living in Africa. Most diets, in sub-Saharan Africa consist mainly of cereal or root staple crops, and very little in the way of animal source proteins, micronutrient rich vegetables and fruits, and quality diversity of the food basket. These foods are either not accessible because of high cost, not locally available, unequally distributed within households or are not considered household priorities when incomes are not sufficient to meet the needs of a high quality diet [19].

Focusing on the individual level, food utilization also takes into consideration the biological utilization of food. Biological utilization refers to the ability of the human body to take food and convert it into energy either used to undertake daily activities, or stored. Utilization requires not only an adequate diet, but also a healthy physical environment, including safe drinking water, fuel needed for cooking, adequate sanitation and hygiene, decreased burden of infectious disease, and the knowledge and understanding of proper care for oneself, for food preparation, storage and safety.

To meaningfully incorporate the nutrition elements into the concept of food security, it is important ensure "adequate protein, energy, vitamins, and minerals for all household members at all times" [20]. But going beyond just food intake to include health and environmental factors, *nutrition security* is when a household has secure access to food coupled with a sanitary environment, adequate health services, and knowledgeable child care practices [21].

One element in establishing food and nutrition security is to ensure that households, communities and nations do not go hungry. As **Figure 1** shows, hunger impacts an estimated 925 million globally [22] and 195 million children are stunted, with
90% of these children living in just 36 countries [15, 23]. Sub-Saharan Africa holds the second highest burden of those who suffer from hunger with 239 million peoples as food insecure after South Asia.

Figure 1: Number of People who are Hungry (FAO 2010)



Source: FAO.

In the developing world, malnutrition is the single largest killer of children under 5, trapping regions in a cycle of extreme poverty. But on the other end of the spectrum, obesity is

dramatically on the rise not only in developed, industrialized countries but in low-income and transition countries, some in Africa, as well, which will have a tremendous impact on frail, overburdened health care systems and the productivity levels of the workforce.

While a number of countries globally have made substantial gains in reducing levels of those suffering from hunger and stunting, declines in children who are stunted in the African region have been marginal - from an estimated 38% in 1990 to 34% in 2008 [15]. Moreover, with population growth, the overall number of African children who are stunted has increased from an estimated 43 million in 1990 to 52 million in 2008 [15]. In 2008, the ratio of those children who are underweight in rural to urban areas in sub-Saharan Africa was 1:4 [24]. At the same time, 10% of children are overweight or obese in 8 of 45 sub-Saharan African countries [24].

The issue of hunger

Malnutrition can take several forms including hunger, undernutrition, overnutrition and micronutrient deficiencies. In its common usage, hunger describes the subjective feeling of discomfort that follows a period without eating [25]. However even temporary periods of hunger can be debilitating to longer term human growth and development [26]. Acute hunger is when lack of food is short term but significant and is often caused by shocks, whereas chronic hunger is a constant or recurrent lack of food [27]. Reducing levels of hunger has traditionally placed the emphasis on the quantity of food, and refers to ensuring a minimum caloric intake is met.

For the last ten years, hunger has been measured against the achievement of the Millennium Development Goal (MDG) One with a target to reduce the proportion of people who suffer from hunger by half between 1990 and 2015 [28], with hunger measured by two indices: as the proportion of the population who are undernourished and the prevalence of children under five who are underweight [29]. Many countries remain far from reaching this target, and much of the progress made has been eroded by the recent global food price and economic crises in 2007-2008 and in 2011. Africa has also suffered progress as measured by these globally monitored indices.

The underweight prevalence indicator*:* The underweight indicator of the MDG1 is the proportion of children under five years of age falling below minus 2 standard deviations (moderate and severe) and minus 3 standard deviations (severe) from the median weight-for-age of the reference population[30]. The underweight indicator was chosen for the MDG 1 target as it is felt to be the single best composite indicator, with the potential to capture aspects of acute and chronic undernutrition combined. As **Figure 2** shows, Africa still suffers from a tremendous burden of undernutrition of 25% of children under five who are underweight as compared to other regions of the world. West and East Africa have a higher burden compared to North Africa. Although, South Asia suffers the highest burden, Africa's burden, along with other compounding factors, will be a challenge for years to come.

Achieving sufficient progress in reaching the MDG1 indicator for underweight will be difficult for many African countries. **Figure 3** shows in red and yellow colors that many

African nations have made insufficient progress towards achieving the MDG1 goal as of 2009, or no progress at all as measured by the average annual rate of reduction (AARR). AARR of underweight is based on multiple data estimates available from 1990 to 2008 with the AARR needed to achieve a 50% reduction over a twenty five-year period (1990 to 2015). The rate of change required to achieve the goal is a constant 2.8% reduction per year for all countries [31]. There are exceptions in sub-Saharan Africa including Angola, Botswana, Congo, Ghana, and Mozambique.

Figure 2: Percentage of Children under Five who are Underweight for Age (2003-2008)

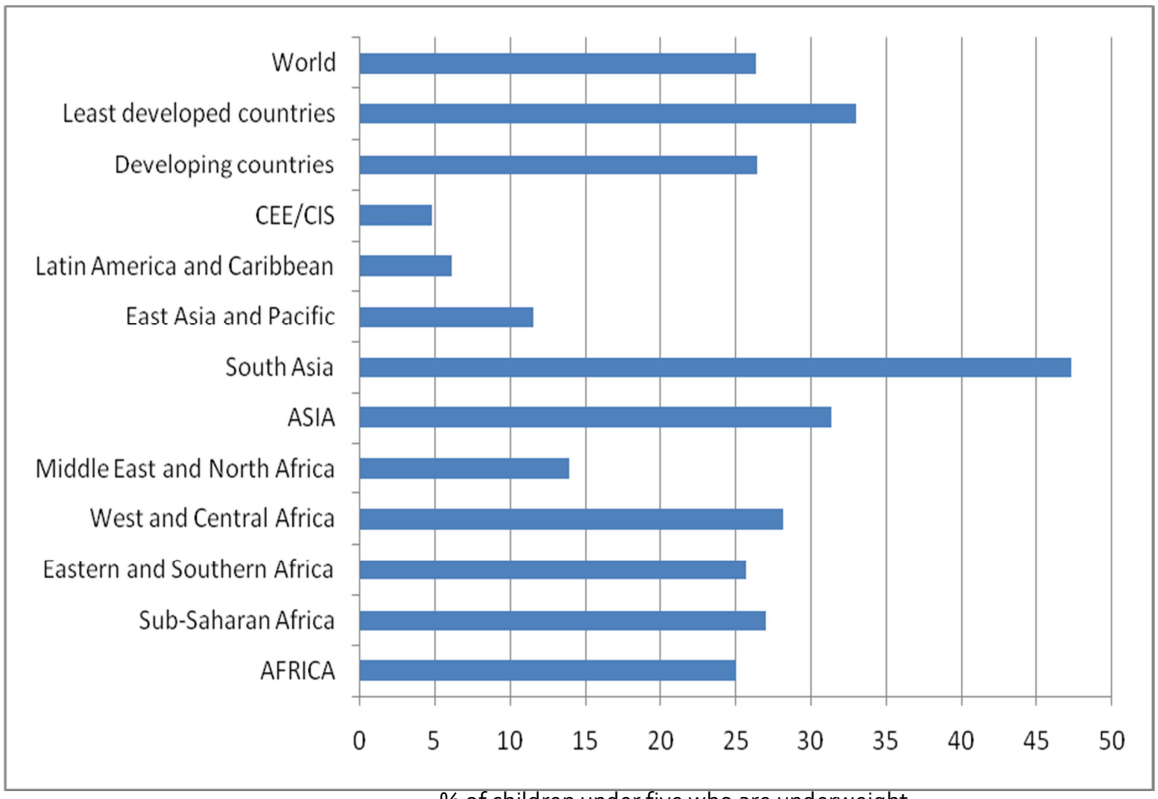
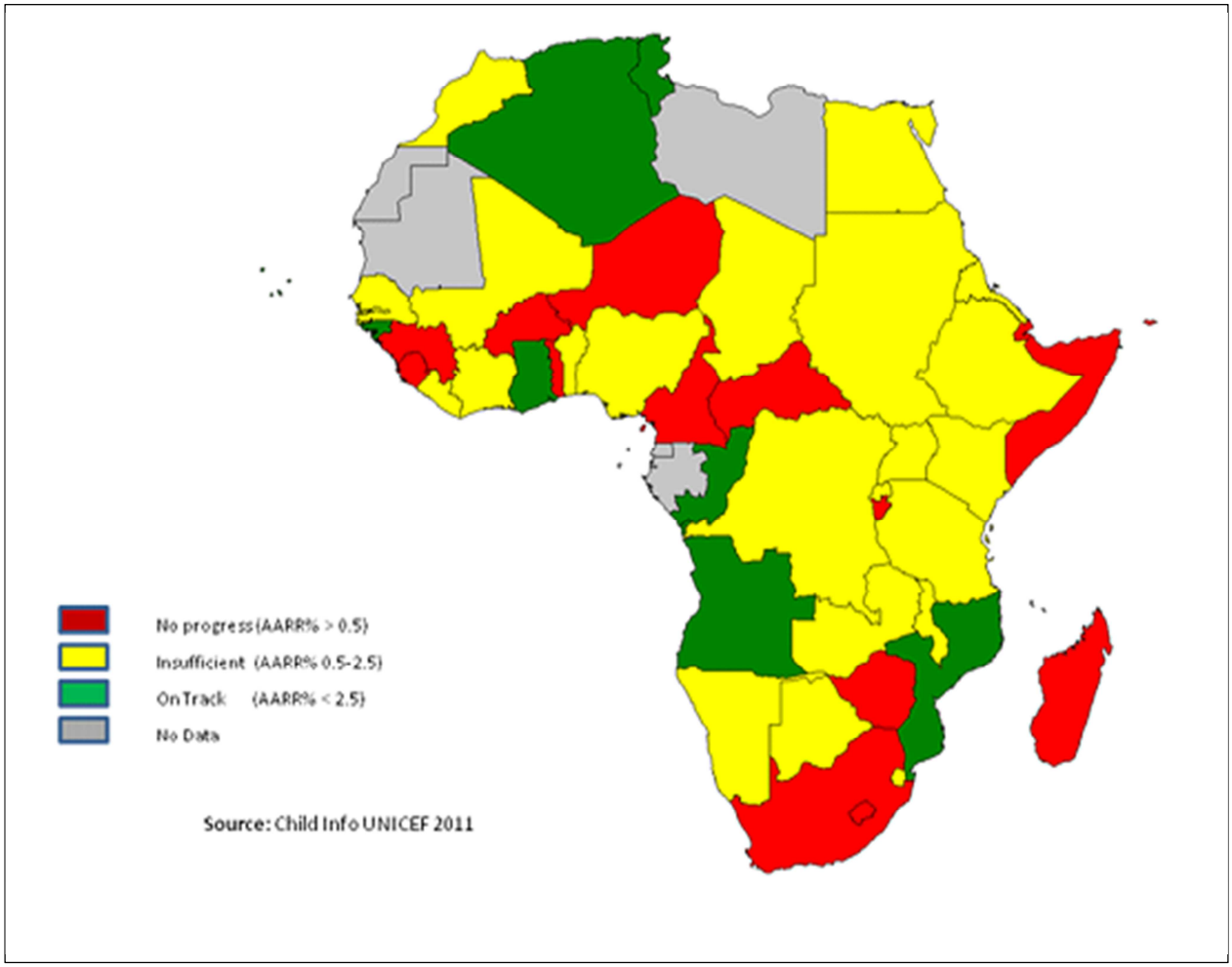
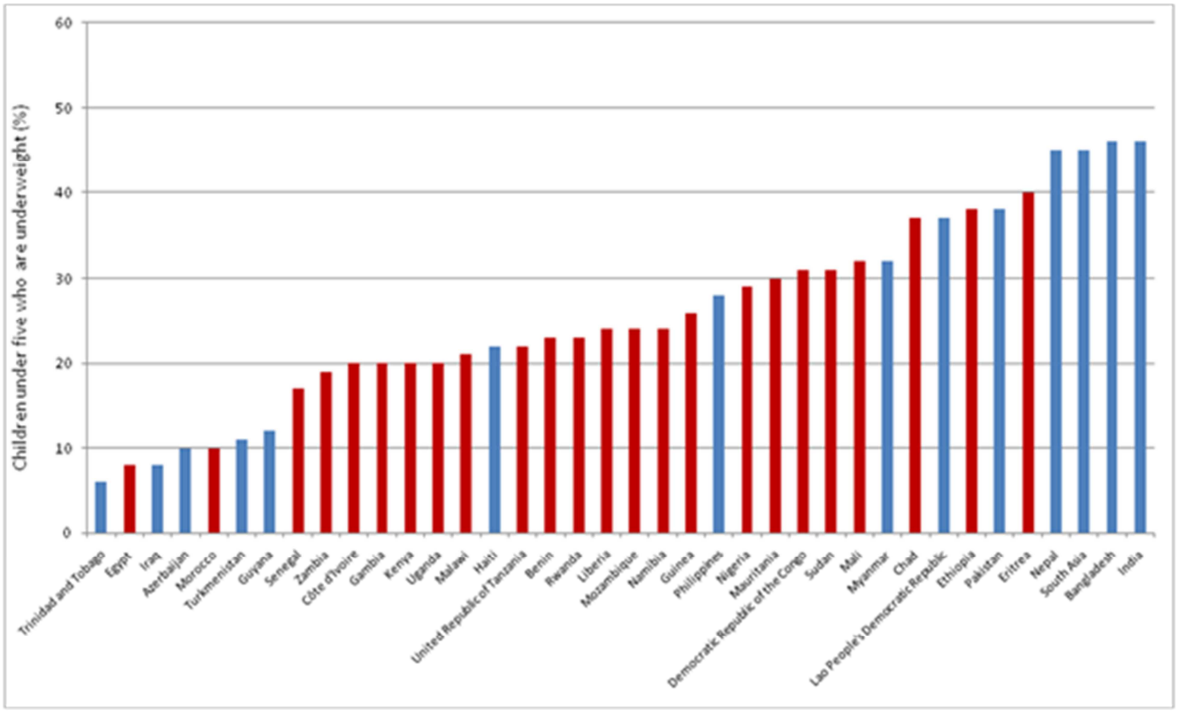


Figure 3: Progress towards the MDG1 Underweight for Age Indicator



For those countries which have "insufficient progress" in reducing child underweight rates, 38 of 129 countries, 60% are in Africa (as shown with red bars in **Figure 4**). Overall decline in underweight rates has decreased just 3% between 1990 and 2008 (28% to 25%) in Africa. In sub-Saharan Africa, countries with the highest underweight prevalence are Chad, Eritrea, Ethiopia, Madagascar, and Niger. Conversely, some countries as shown in **Figure 3** within the region are well on track to meeting MDG1 including Angola, Botswana, Congo, Ghana, Guinea-Bissau, and Mozambique, [31]. Although not all will be able to meet the goal in cutting hunger in half, some highlighted declines in underweight rates include Mauritania (57% to 27%), Malawi (29.9% to 21%) Ghana (27% to 9%) and Mozambique (27% to 18%) [31].

Figure 4: Percentage of Children under five who are Underweight in Countries Making Insufficient Progress toward the MDG1



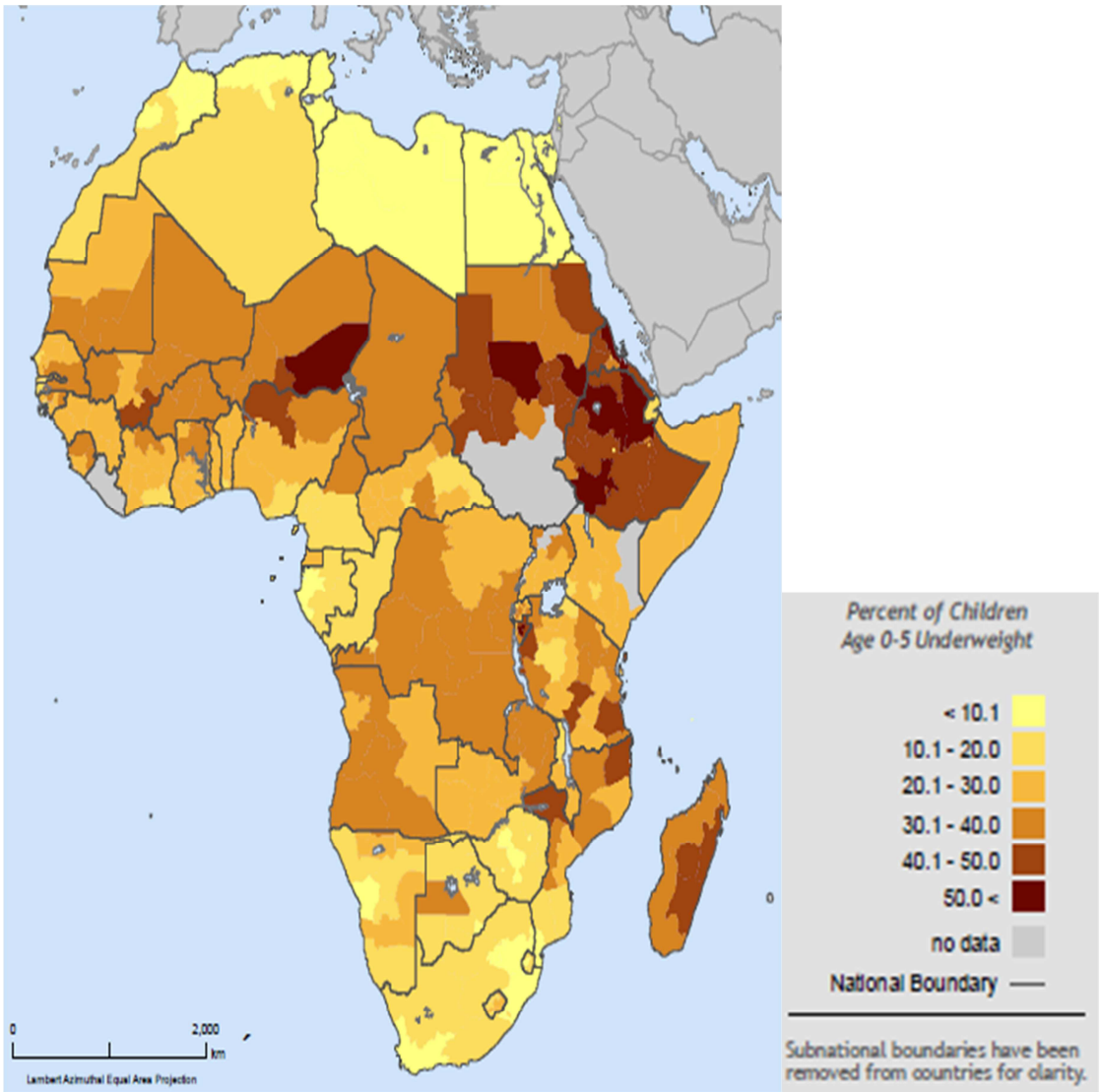
Understanding where the "hotspots" of undernutrition are located on the continent can serve as proxies for identifying vulnerabilities and where targeted focus should be given priority. In **Figure 5,** the maps demonstrate where the hotspots of hunger are, as a percentage of children underweight for age, and an index that combines the proportion of children underweight and the population density of underweight
children for each surveyed region. To create the index, each measure is normalized such that its new average, over all regions, is zero, and its standard deviation is 1. The two normalized values are added for each region to create the new index. The mapped classes are quintiles of the full distribution of the index [32]. Areas in Southern Nigeria and Ethiopia are highlighted, as well as areas in Uganda and Kenya surrounded by Lake Victoria.

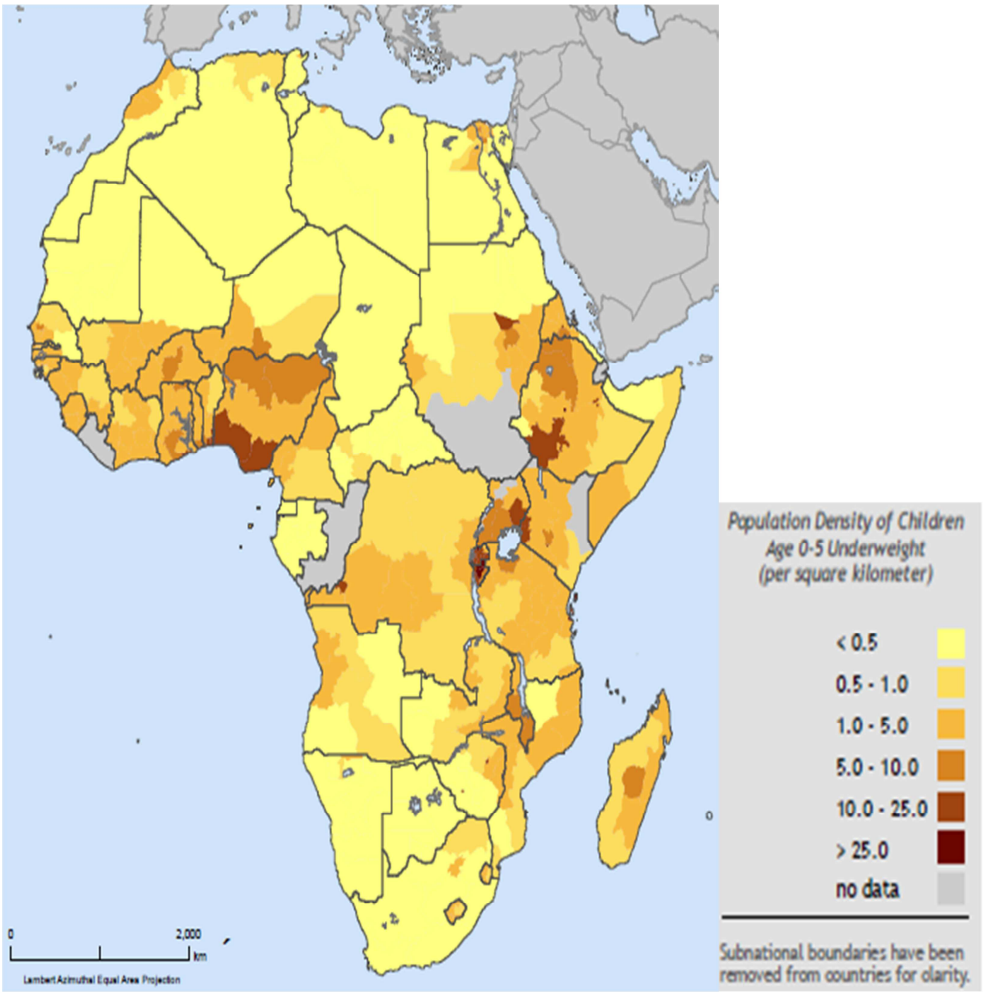
Proportion undernourished indicator*:* The second hunger indicator of the MDG1 refers to *undernourishment* defined as the insufficient food intake to continuously meet dietary energy requirements [33] with FAO further defining hunger as the consumption of less than 1600-2000 calories per day. The measure is a complex estimation of a distribution function of dietary energy consumption on a per-person basis. The mean of this distribution refers to the usual food consumption level and is estimated by the daily dietary energy supply per capita for a country derived from its food balance sheet (averaged over three years). The variance is derived on the basis of food consumption or income data from household income and expenditure surveys. The proportion of undernourished in the total population is defined as that part of the proportion lying below a minimum energy requirement after taking into account a country's sex and age distribution, assuming the minimum acceptable

body weight for given height for all sex–age groups and a light activity levels for adults [34] [35].

Although Asia still has the highest level of undernourished persons, sub-Saharan Africa has since 1990, increased its numbers of undernourished persons and the proportion of undernourished people remains highest at 30%, but progress varies widely at the country level (**Figure 6**). The Congo, Ghana, Mali and Nigeria had already achieved MDG 1 whereas in the Democratic Republic of the Congo, the proportion of undernourishment had increased to 165% [22].

Figure 5: Index Combining Normalized Rates of Underweight Prevalence and Population Density of Underweight Children in Africa [32]



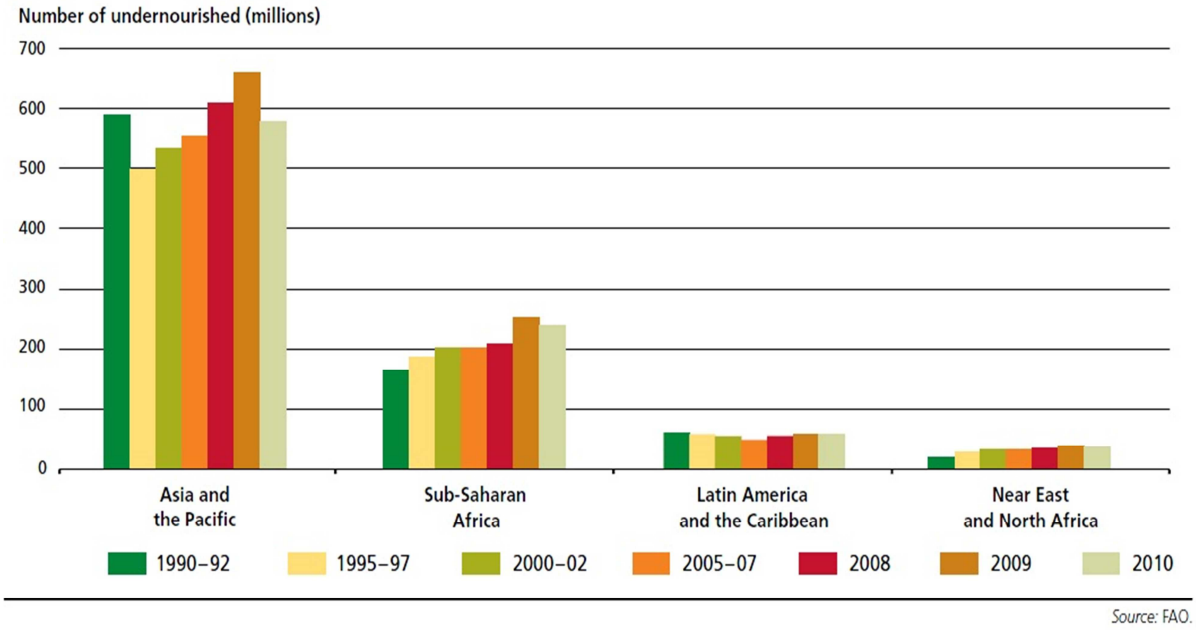


These undernourishment estimates are difficult to collect at the field level, and it remains questionable how accurate a picture these data capture [36]. For example, available national data does not always reflect the disparities and pockets of undernutrition existing in some countries [37]. The FAO estimates show a decrease of those who are hungry during periods of increased national production because of assumed constant distribution of food nationally (household surveys are rarely undertaken, thus the distribution of calories is based on the previous survey). This emphasizes only the benefits of policies and programs focused on food availability, which we now understand is a limited view. Studies show that rising production may not have any impact on people's *access* to food, and does not take into account the quality of food accessed or consumed [38-40]. Although it presents issues, the FAO data is still regularly used and quoted.

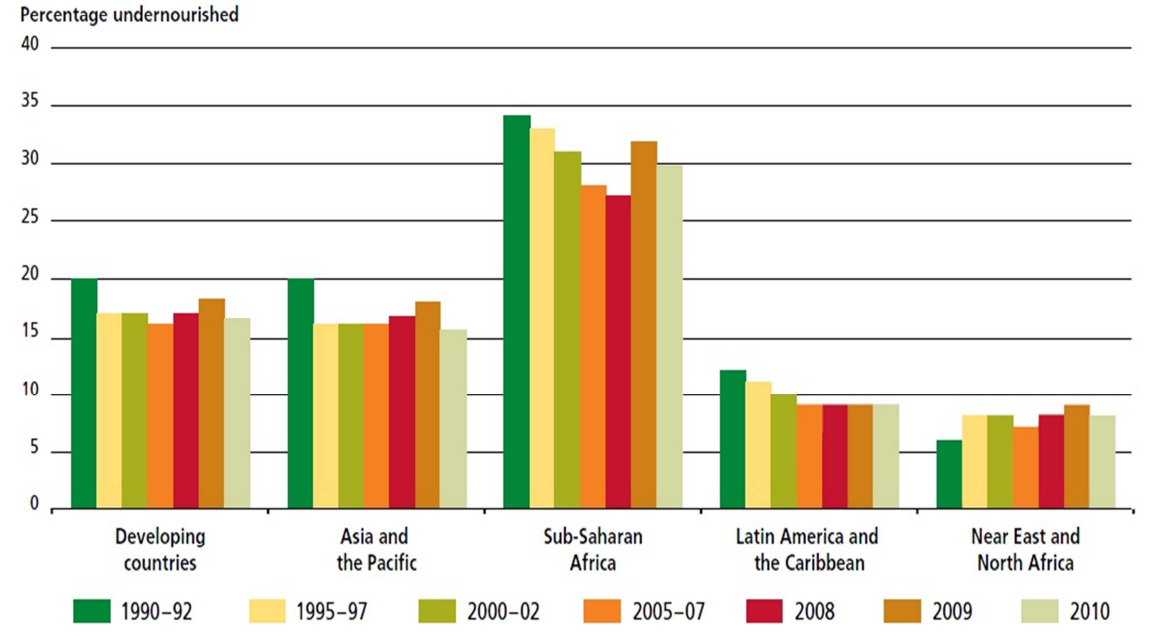
Alternative hunger indicators: Others have developed new hunger indicators in an attempt to better capture the progress towards the MDG1 including the Global Hunger Index and the Poverty Hunger Index [35] [41]. The Poverty Hunger Index (PHI), which builds

on the Human Development Index, combines the five official MDG1 indicators including the poverty indicators, equally weighted with minimum and maximum values chosen for each underlying indicators (minimum being zero). This index takes all five separate measures into account simultaneously, allowing countries to track their own net progress towards MDG1, both poverty and hunger [35].

Figure 6: Number of Undernourished and the Percentage of Undernourished Globally [22]



Source: FAO.

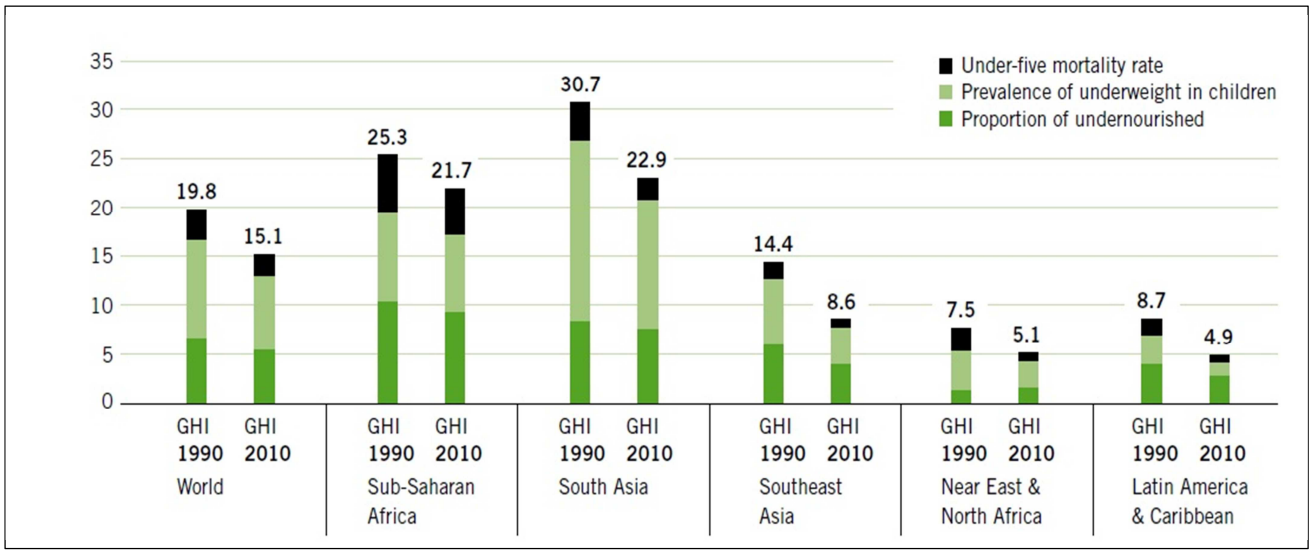


Source: FAO.

International Food Policy Research Institute's (IFPRI) Global Hunger Index (GHI) relates three indicators - the proportion of people who are caloric deficient, the prevalence of underweight in children under the age of five, and the mortality rate of children under the age of five – weighted equally over time starting with 1981. The GHI varies greatly by region and country [41] and although it takes into account mortality, the data varies from the MDG tracking data.

From the 2010 GHI **Figure 7**, there has been improvements in the index in Africa, but overall the continent has made the least progress. The GHI attributes this lack of progress to low government effectiveness, political instability and conflict and high HIV rates. Only one country in Sub-Saharan Africa – Ghana – is among the 10 best performers in improving their GHI score in the last twenty years. The GHI has worsened in nine countries all which are in Sub-Saharan Africa, except for North Korea. The Democratic Republic of Congo fared the worst, due to conflict and political instability. Burundi, Comoros, Guinea-Bissau, Gambia and Liberia also had a high GHI. In Swaziland, the high prevalence of HIV and AIDS has severely undermined food security. Zimbabwe has also failed to improve due to the economic collapse and lack of government support in the country [42].

Figure 7: Progress in Different Regions as Measured by the Global Hunger Index (1990 to 2008) [42]



The Multidimensional Poverty Index (MPI) is an international measure of poverty. It identifies people who contend with multiple poverty deprivations across three dimensions: education, health, and living standards. One of the indicators is nutrition - deprived if any adult or child for whom there is nutritional information is malnourished. A person is identified as multi-dimensionally poor if they experience deprivation in at least 30% of the weighted indicators. One deprivation alone may not represent poverty. Of the 104

countries representing 5.2 billion people, 92% of the population of developing countries analyzed, 28% live in sub-Saharan Africa. Twenty six African countries have an MPI above 0.32 (410 million people) [43].

The consequences of hunger and beyond: Malnutrition

Reducing levels of *hunger* places the emphasis on the quantity of food, and refers to ensuring a minimum caloric intake is met. Conversely, ensuring adequate *nutrition* refers to a diet's quality as one factor. A diet rich in proteins, essential fatty acids, and micronutrients has been proven to improve birth weight, growth, and cognitive development while leading to lower levels of child mortality [23, 44].

Malnutrition is a broad term commonly used to describe people who are malnourished due to the fact that their diet does not provide adequate calories, protein for growth and maintenance, and micronutrients; or they are unable to fully utilize the food they eat due to illness or lack of safe water. A lack of these essential vitamins and minerals often results in "hidden hunger" where the signs of malnutrition and hunger are less visible in the immediate sense. This can result in the nutrition disorder of undernutrition. One of the major long-term determinants of malnutrition is poverty, in both developed and developing countries.

Global acute malnutrition, or "wasting", is defined as low weight for height or the presence of oedema. It can be moderate (MAM) or severe (SAM). It occurs as a result of recent rapid weight loss, malnutrition, or a failure to gain weight within a relatively short period of time. Wasting occurs more commonly in infants and younger children and is a result of deficiencies in both macronutrients (fat, carbohydrate and protein) and some micronutrients (vitamins and minerals). Recovery from wasting is relatively quick once optimal feeding, health and care are restored though it may leave permanent debilitating impacts such as cognitive impairment.

SAM is the most dangerous form of malnutrition. SAM affects 20 million children under five years of age each year and contributes to 1 million child deaths per year
[45]. MAM contributes more to the overall burden of disease as compared to SAM, as it affects many more children [46]. MAM also has a higher burden than SAM and currently affects 35 million children [23].

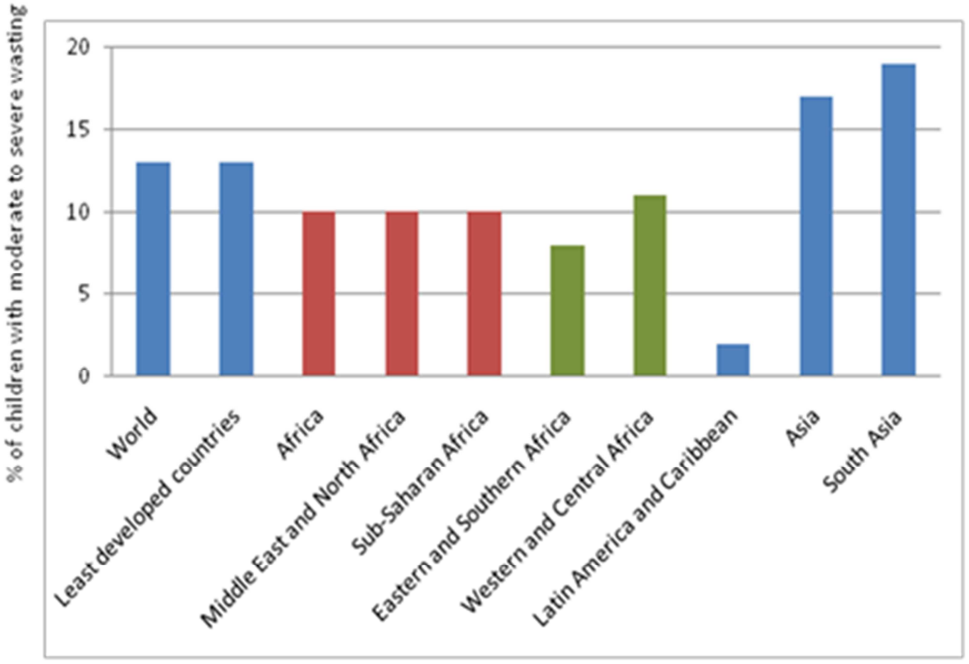
In Africa, wasting rates are high and have not shown significant improvement overall. As shown in **Figure 8**, Africa currently estimates 10% of children who are moderate to severely wasted whereas South Asia rates rise above 15%.

TEXT BOX 1:
Community Management of SAM in Malawi

Malawi, with droughts in both 2002 and 2005, began piloting CMAM with UNICEF, Concern and Valid International in select districts. Once piloted in two districts, the monitoring results were encouraging with 87% of children discharged successfully from the program [6] [9]. Since this pilot, the program has been scaled nationally, and is considered a model for national coverage. For the scale up program, the national MOH is in the lead, providing direction, resources and support directly to district health offices. NGOs have contributed additional technical support to the CMAM Support Unit. Currently, 344 CMAM sites and 96 inpatient units have been implementing the program in 24 of 28 districts of Malawi [13]. Malawi is now reaching 74% of children in need of treatment with a 75% recovery rate [15].

Nigeria (14%), Ethiopia (12%), Sudan (16%), the DRC (10%) and Egypt (7%) are among the ten countries with the largest number of children under five with wasting globally [37]. The solutions geared towards addressing wasting are just as complex, however new initiatives, such as Community Based Management for Acute malnutrition and ready to use therapeutic foods, hold much promise in treating severe cases rapidly and in low-resource situations across sub-Saharan Africa (see **Text Box 1**). This has been successfully demonstrated in places such as Malawi, Ethiopia and Niger.

Figure 8: Percentage of Children Under Five Suffering from Moderate to Severe Wasting (2003-2008) [31]



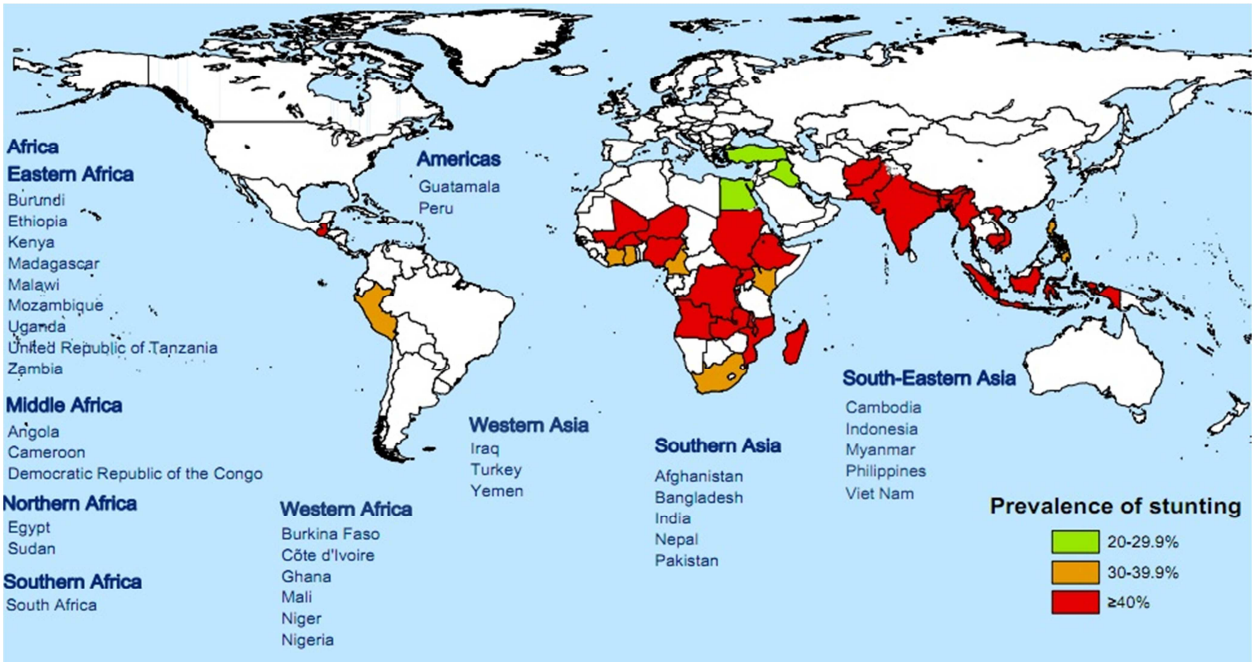
Although wasting is a serious situation and the numbers are still too high, the larger burden for Africa is stunting – the failure to grow in stature, which occurs as a result of inadequate nutrition over a longer period. It measures the chronic deprivation of inadequate food intake, poor health and poverty resulting in poor child growth potential. Stunting of children under five years of age is a stronger indicator of hunger and endemic poverty. Global and country level stunting prevalence is often far more severe than undernutrition and wasting, and more accurately reflects nutritional deficiencies and sickness that occur during times of growth for a child. Moderately and severely stunted children (whose height-for-age ratios are two standard deviations below the international standard) have retarded physical and cognitive growth and negative implications for child development, and school and work performance.

Some have contested the choice of using the underweight measure as the most appropriate nutrition indicator. The UN Standing Committee on Nutrition (UNSCN) has promoted stunting of children under five years of age as a stronger indicator of hunger and

of one of its determinants, poverty. Stunting itself measures the chronic deprivation associated with inadequate food intake, poor health and poverty resulting in poor child growth potential [47]. The UN SCN Task Force on assessment, monitoring and evaluation has suggested that "for monitoring the progress made towards the achievement of MDG 1, it is recommended that both countries and development partners report against the prevalence of stunting in children below the age of five as an internationally agreed indicator of endemic poverty" [48]. Global and country level stunting prevalence is often much more severe than undernutrition and wasting, and more accurately reflects nutritional deficiencies, and sickness that occur during times of growth for a child [15]. As a minimum, stunting should be tracked alongside the underweight indicator to get a better assessment of undernutrition in African countries.

Of the top 20 countries with the highest prevalence of stunting, 9 are in Africa, 10 are in Asia, and 1 is in the middle east (Yemen) [15, 49]. Of the 36 countries with the highest burden of stunting amongst children under two years of age, 21 are in Africa and most of those have a prevalence of 40% or more children stunted as shown in **Figure 9** [49]

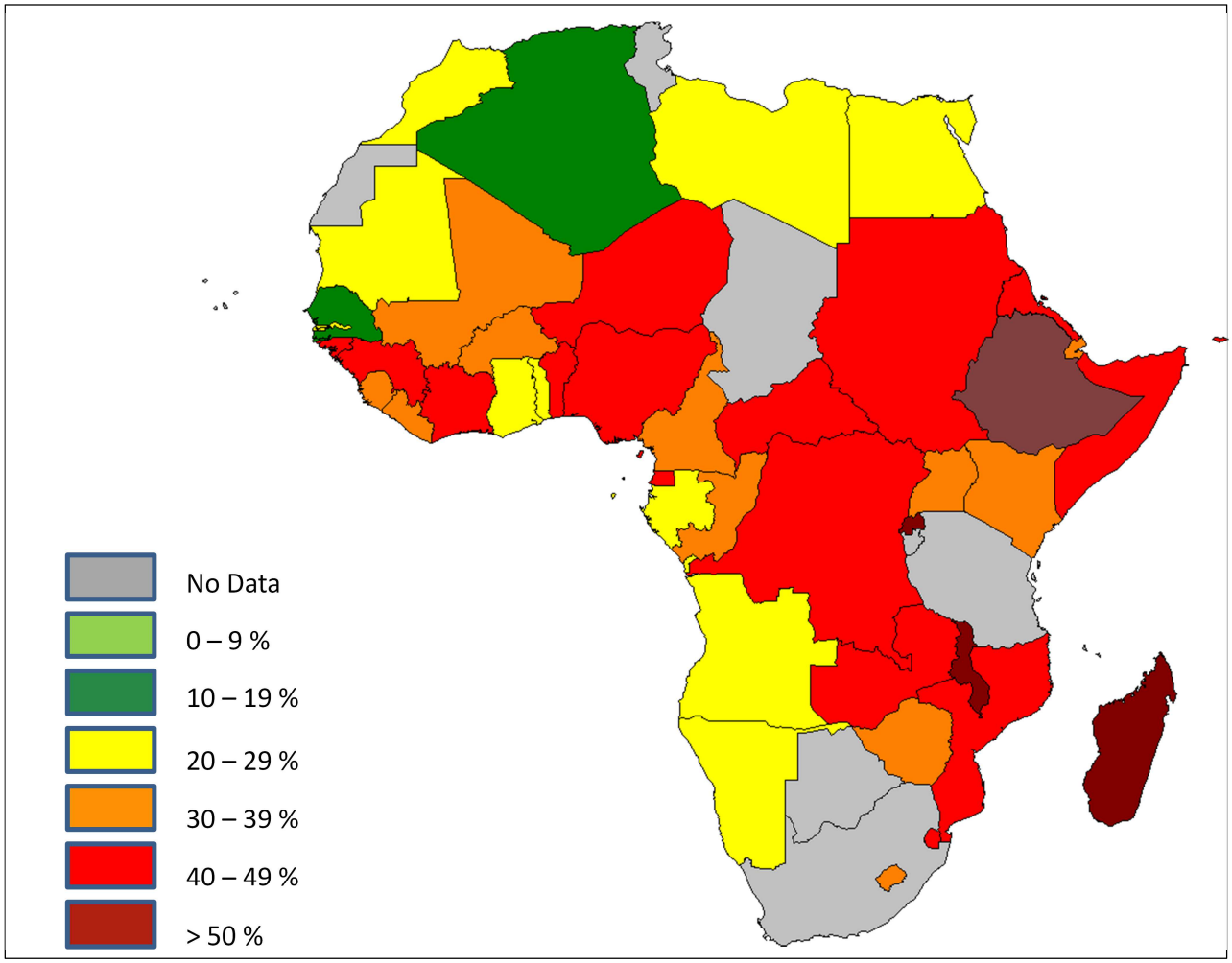
Figure 9: Thirty-six Countries with the Highest Burden of Stunting Globally [49]



Stunting has declined overall in Africa, from 38 to 34%, however this progress is clearly not enough (UNICEF 2009). When looking at absolute numbers, the number of children under five years of age who are stunted has increased by nine million, largely due to the continent's population growth. Between 1990 and 2008, stunting rates declined significantly in the following countries: Mauritania (57% to 27%), Uganda (45% to 32%), Mozambique (55% to 44%), Ethiopia (64% to 47%) and Eritrea (66% to 38%) [37].

The geographic distribution of stunting across the 41 sub-Saharan countries with recent data reveals interesting patterns as depicted in **Figure 10**. Two areas stand out as having high levels associated with stagnant or deteriorating trends (as shown in dark orange and red): the Sahel (from Mali east to Chad), the horn of Africa, and southeastern Africa (from Rwanda and Zambia east to Mozambique and Madagascar). [31]

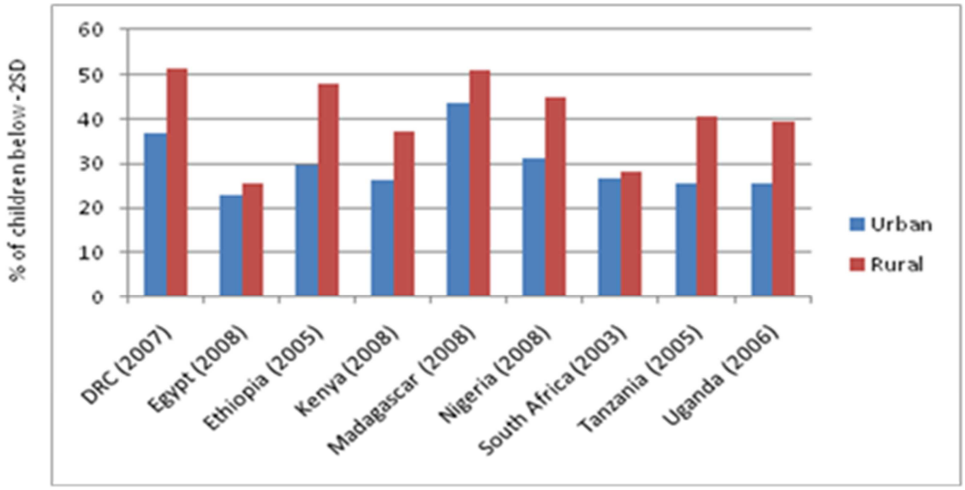
Figure 10: Prevalence of Moderate to Severe Stunting in Children Under Five Years of Age [31]



However stunting is not just a rural phenomenon. **Figure 11** shows that amongst urban children under five years of age, stunting is a significant issue in select African countries with a high burden of undernutrition, although levels are not as severe as in rural areas [50]. This is not just an issue of rich versus poor either. Data indicates that although undernutrition rates in sub-Saharan Africa are higher among poorer households, rates remain relatively high among the non-poor. In many countries in the region, more than 15% of the children in the highest wealth quintile are underweight. Improved household welfare

in itself is not sufficient to eliminate undernutrition. The higher level of nutritional resources available to wealthier households must be used effectively through proper care if undernutrition is to be eliminated in such households [21].

Figure 11: Stunting in Children Under Five in Rural Versus Urban Populations in the African Countries with the Highest Burden of Stunting [50]



Micronutrients and hidden hunger

Micronutrient intake is another element in assessing undernutrition in Africa. A person may have access to a sufficient amount of calories but lack adequate micronutrients [51]. A lack of these micronutrients, or essential vitamins and minerals often results in "hidden hunger" where the signs of undernutrition and hunger are less visible. This phenomenon has been defined as "hidden hunger" because although the symptoms are not always obvious it causes devastating, sometimes lifelong, consequences on health, productivity, and mental impairment [52]

Micronutrient deficiencies inflict anaemia, cretinism and blindness (xerophthalmia) on tens of millions of people. Levels of mineral and vitamin deficiency that have no clinical symptoms can impair intellectual development, compromise immune systems, provoke birth defects, and cause individuals to live below their physical and mental potential which ultimately impairs their capabilities and the prospects of nations. Half of children with vitamin and mineral deficiencies are suffering from multiple deficiencies [52].

Recent data highlights an estimated 2 billion people suffer from one or more micronutrient deficiencies [53], demonstrating that hidden hunger is responsible in part for the global malnutrition burden. Four micronutrients of public health concern, which have devastating consequences for many individuals are vitamin A, iron, folate, and iodine.

- ***Vitamin A deficiency*** compromises the immune systems of approximately 40% of the developing world's children under five years of age and leads to the early deaths

of an estimated one million young children each year [52]. As shown in **Figure 12a,** severe vitamin A deficiency amongst preschool age children afflicts almost the entire sub-Saharan African region. In **Figure 12b,** deficiency prevalence ranges from 20 to 40% on average across regions with little improvement in the last twenty years [54]. Twenty-five countries in Sub-Saharan Africa reached 70% or more of their young children with one vitamin A capsule every year saving the lives of more than 200,000 young children annually and reducing the severity of childhood illnesses in 2008. These countries include Angola, Benin, Gambia, and Guinea. Burkina Faso, Ghana, Sierra Leone, and Tanzania have been reaching their young children with the two required high-doses of vitamin A annually.

Figure 12a: Vitamin A Deficiency (as measured by serum retinol) in Preschool Age Children Globally [55]

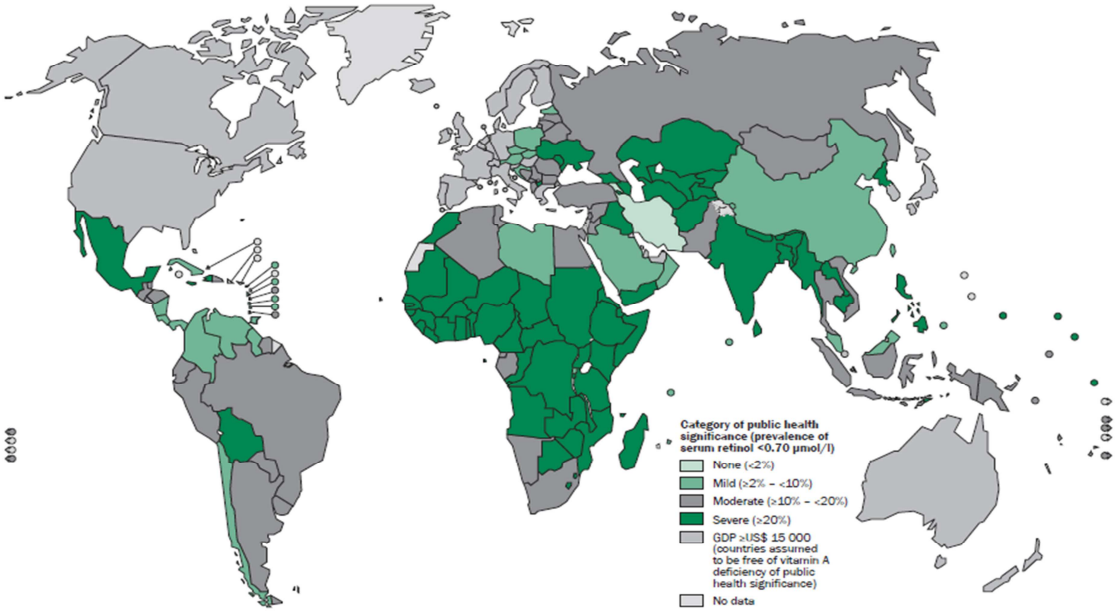
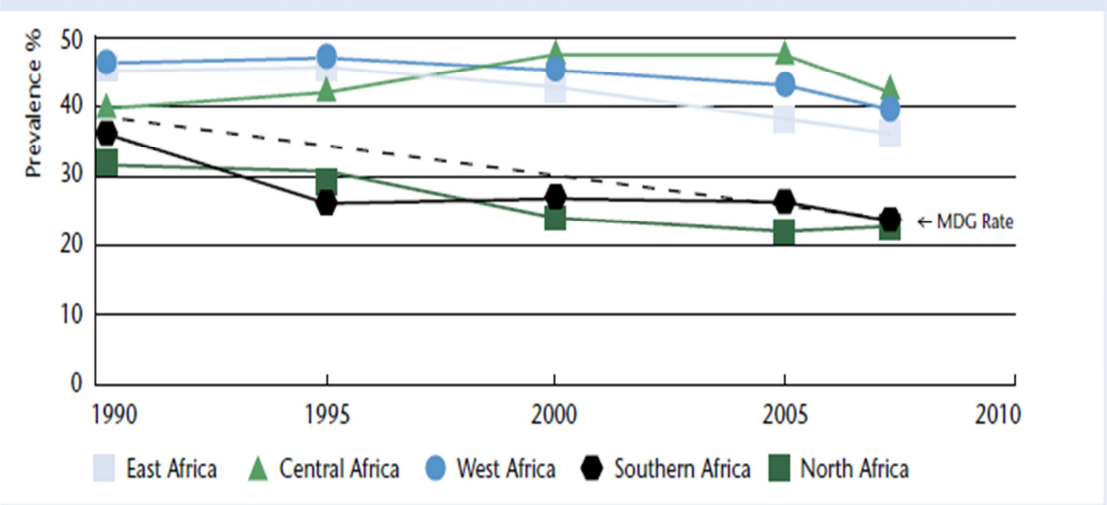


Figure 12b: Vitamin A Deficiency in Children in Africa (1990 to 2010) [54]



- ***Iron deficiency*** in the 6-to-24 month age group impairs the mental development of 40% to 60% of the developing world's children. Severe iron deficiency (anaemia) causes the death of an estimated 50,000 young women a year in pregnancy and childbirth. Iron deficiency in adults decreases the development of nations and the productivity of workforces – with estimated losses of up to 2% of GDP in the worst affected countries [52]. As shown in **Figure 13a,** most of the sub-Saharan African region exhibits occurrences of pregnant women with severe rates of anaemia, which is a major risk factor contributing to maternal mortality. For preschool-aged children, non-pregnant and pregnant women, Africa has the highest prevalence of anaemia for all three population groups [56]. In **Figure 13b,** anaemia levels in all regions of Africa have not improved in the last 20 years [54].

Figure 13a: Anaemia Prevalence in Pregnant Women Globally [57]

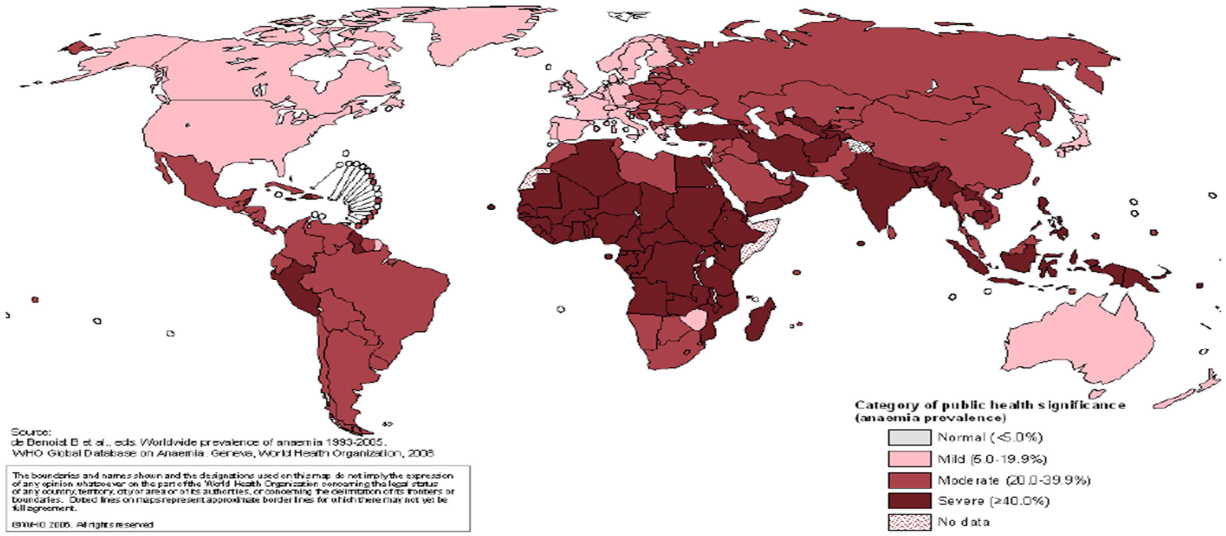
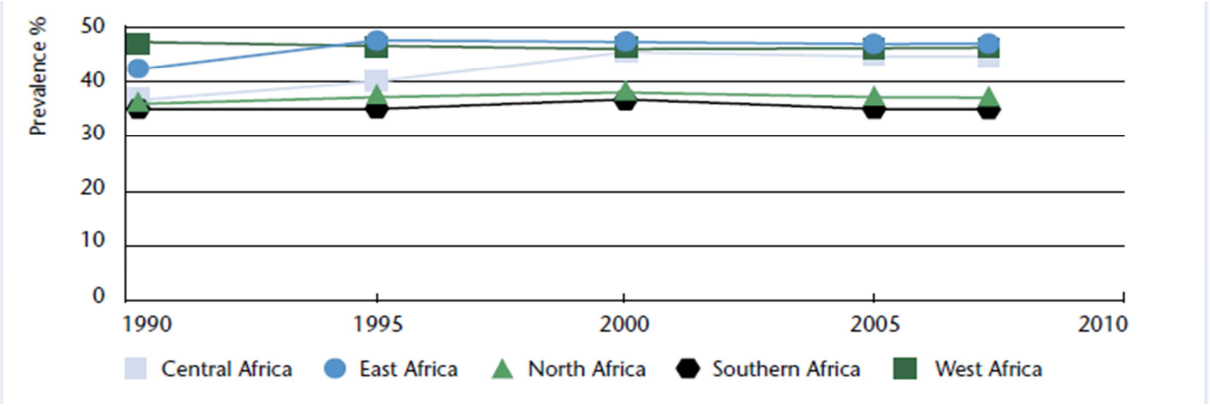


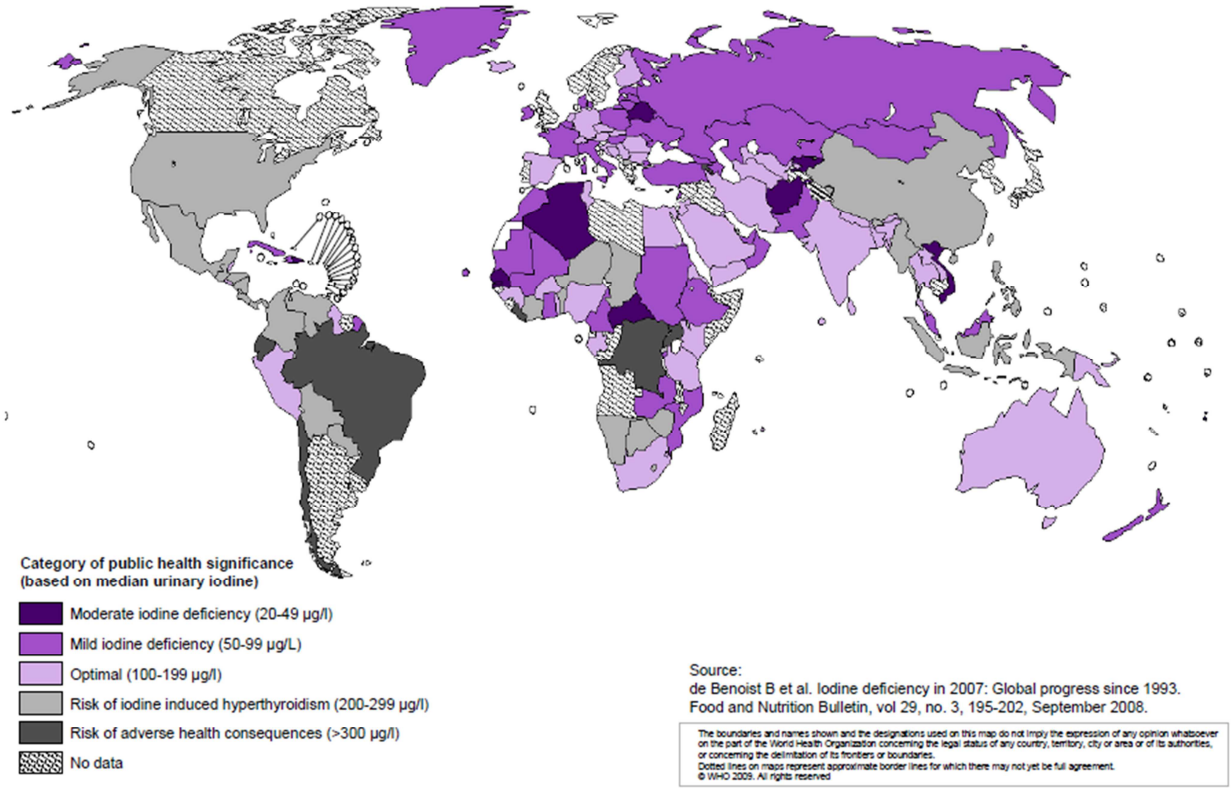
Figure 13b: Trends in Anaemia in Non-Pregnant Women by Region in Africa [54]



- ***Folate deficiency*** causes approximately 200,000 severe birth defects every year and is associated with approximately 1 in every 10 adult deaths from heart disease [52]. In South Africa, a flour fortification programme commenced in 2003 to fortify wheat flour or maize meal with eight micronutrients including vitamin A, folic acid, iron and zinc. The fortification programme led to a significant decline in birth defects, with reductions in spina bifida and anencephaly by 42% and 11%, respectively [58]. It will be important for Africa to scale iron-folic acid supplementation as a routine component of antenatal care.

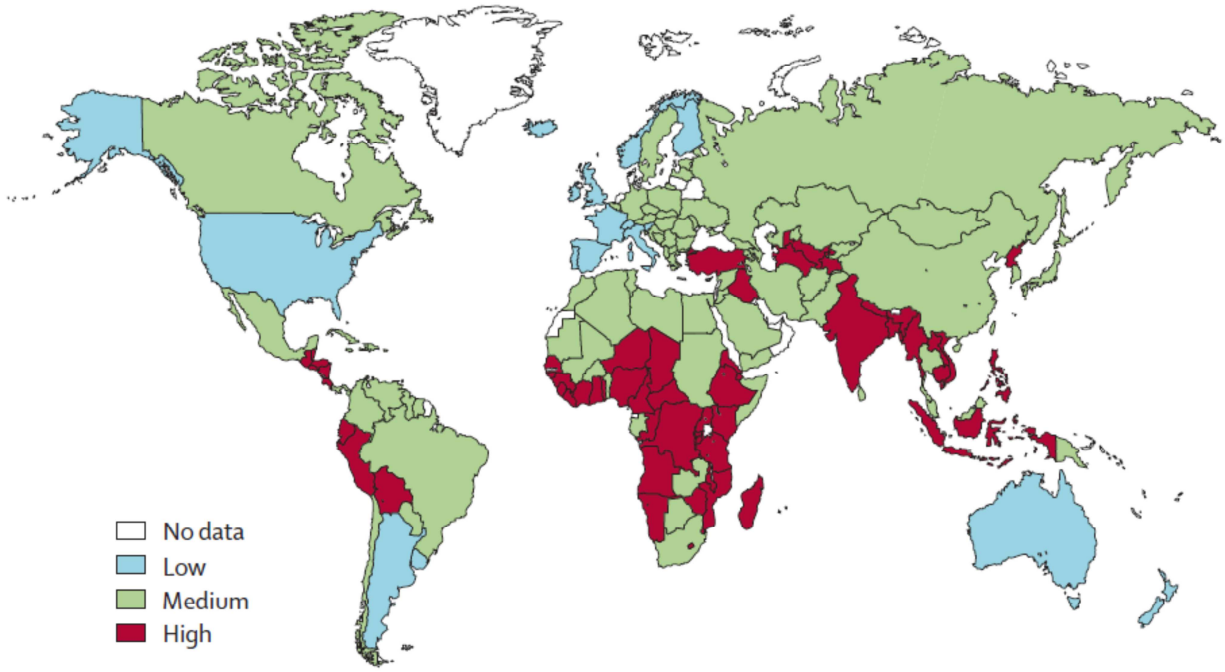
- ***Iodine deficiency*** lowers the total intellectual capacity of almost all of the nations an estimated 10 to 15 percentage points. Iodine deficiency in pregnancy causes approximately 20 million babies a year to be born mentally impaired. Iodine intake is below the required amount in 57 million children in Africa [59]. As shown in **Figure 14,** the levels of iodine deficiency throughout Africa vary. Some selected countries in Sub-Saharan Africa including Benin, Burundi, Cameroon, Central African Republic, the Democratic Republic of Congo, Kenya, Mali, Nigeria, Rwanda, Uganda, and Zimbabwe have attained high levels of iodized salt coverage, thereby protecting approximately 70% of their newborns every year against mental impairment caused by iodine deficiency [52].

Figure 14: Iodine Deficiency Prevalence in Children Globally (WHO 2007) [59]



The estimated numbers of individuals deficient in micronutrients are likely to underestimate the prevalence of hidden hunger because of the actual presence of the various diseases associated with poor nutrition and infectious disease burden in Africa. Moreover, there are potentially many more people who do not have an adequate amount of other essential micronutrients such as B12 and zinc. Unfortunately, data concerning the prevalence of deficiencies in these micronutrients is limited. Zinc deficiency, for example, has proven difficult to quantify and statistics of global prevalence of zinc deficiency remain simply estimates [60]. **Figure 15** demonstrates the prevalence of zinc deficiency in the world, with Africa having the highest burden of zinc deficiency in children under five years of age [23].

Figure 15: Zinc Deficiency Prevalence in Children under Five Globally [23]



Overnutrition and the nutrition transition of Africa

There has been increasing evidence that diets and the prevalence of obesity around the developing world have been changing at an increasingly rapid pace. In many ways, these shifts are a continuation of large-scale changes that have occurred repeatedly over time; however, the changes facing low- and moderate-income countries appear to be very rapid. While initially these shifts were felt to be limited to higher-income urban populations, it is increasingly clear that these are much broader trends affecting all segments of society [61]. In developing countries, African countries included, a double burden of malnutrition is emerging – hunger alongside the health problems associated with overnutrition, such as obesity, diabetes and stroke.

Most countries in Asia, Latin America, Northern Africa, the Middle East and the urban areas of sub-Saharan Africa have all experienced a shift in the overall structure of their dietary pattern with related disease patterns over the last few decades. The dietary shift compounded with increased prevalence of overweight individuals in middle-to-low-income countries is typically referred to as the "Nutrition Transition." It occurs in conjunction with the demographic and epidemiological transitions and has serious implications in terms of public health outcomes, risk factors, economic growth and international nutrition policy.

As shown in **Figure 16a**, body mass index of adult women above 25, which indicates overweight status, is not just found in developed countries such as the United States and Australia, which remain high, but is also found in countries throughout sub-Saharan Africa with rates in South Africa above 50% and in poorer countries such as the DRC, Kenya and Mozambique with 10-20% overweight individuals. This is not just a phenomenon of urban

areas although urbanization plays a significant role in this shift. **Figure 16b** shows women ages 15 to 49 who are overweight or obese (with a body mass index greater than 25) in rural and urban areas throughout Africa. In most countries, urban obesity is higher however in some areas, particularly in northern African countries such as Egypt, Morocco and South Africa, rural obesity is catching up. Even in poor countries, such as Kenya, urban obesity is almost 40% with rural at 20%. **Figure 17** demonstrates that while Africa remains low in the consumption of animal sourced products, countries are consuming more calories per day from these foods particularly in Sudan and Somalia (pastoralist based systems), North Africa and Southern African transition countries.

Figure 16a: Percentage of Adult Females with Body Mass Index Over 25 Globally [62]

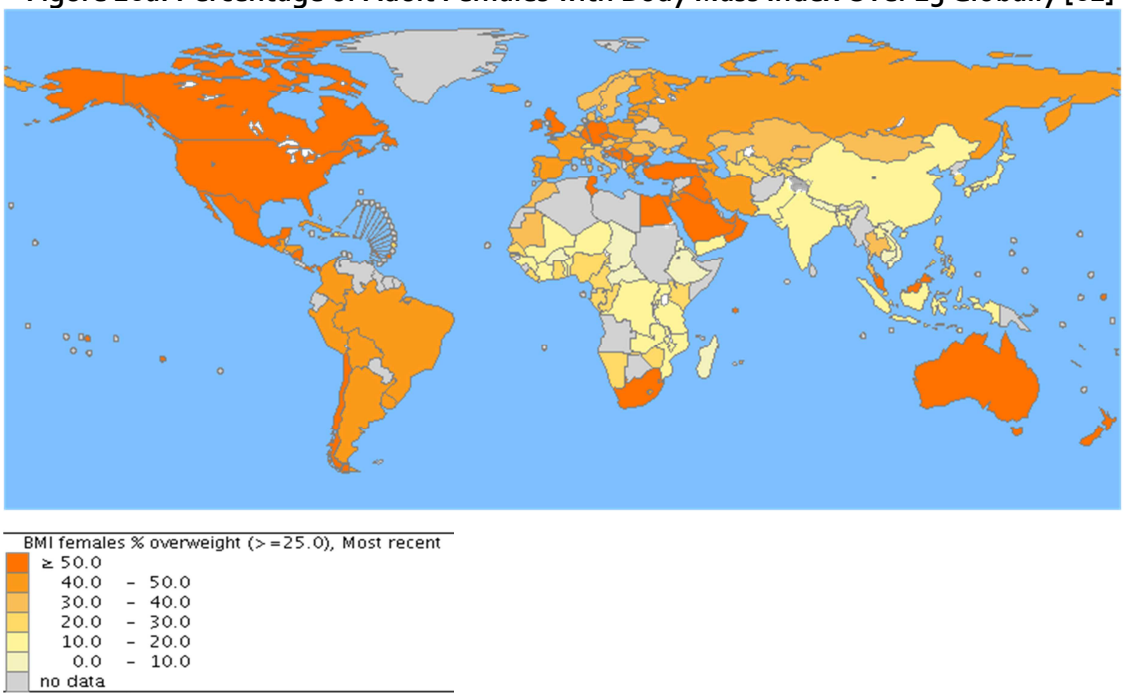
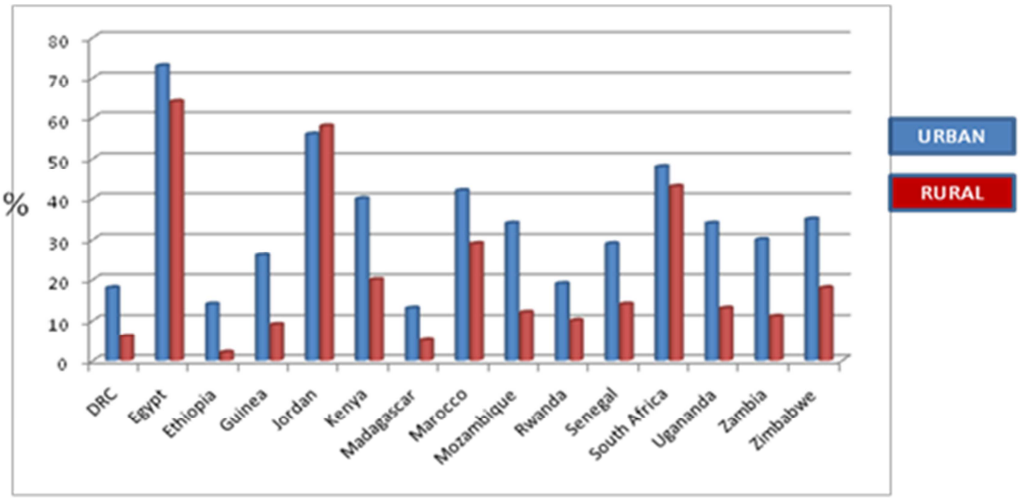
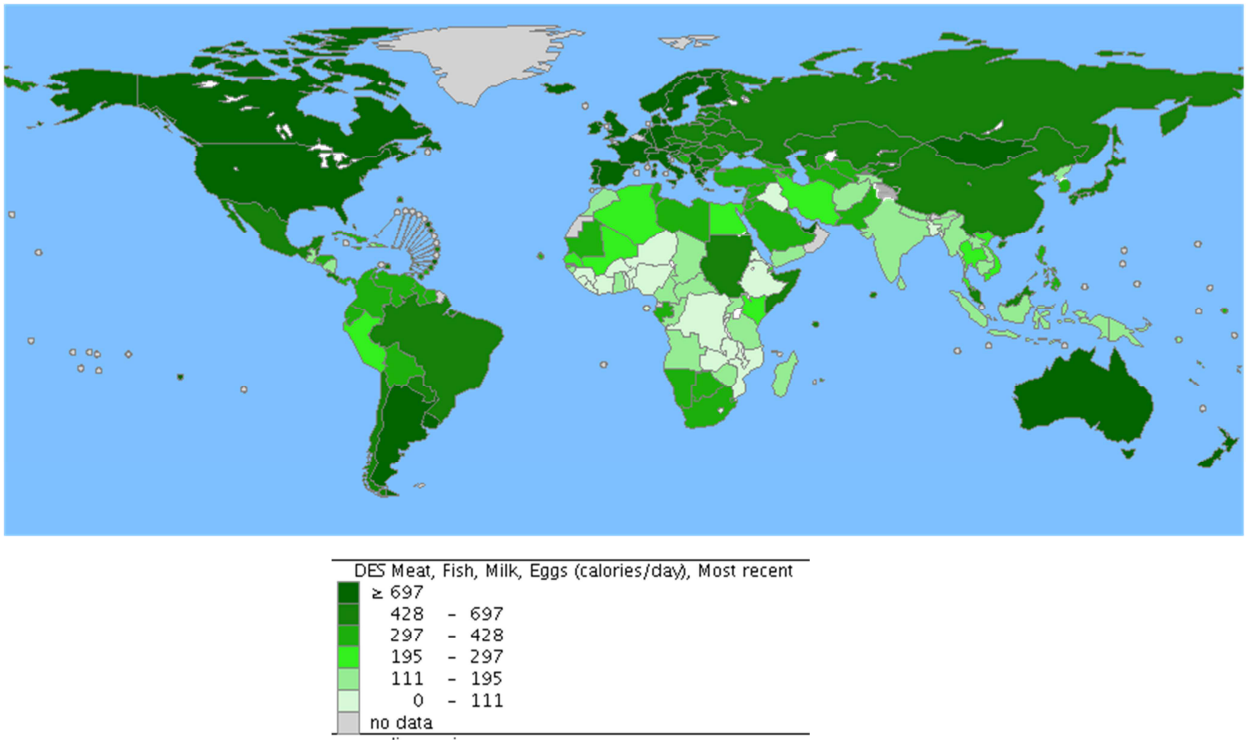


Figure 16b: Percentage of Women Ages 15 to 49 who are Overweight or Obese in Select African Countries [50]



The consumption of specific foods and global shifts in diets clearly play a role in the nutrition transition. Consumption of energy dense, often highly refined, foods high in fat and sugar and low in micronutrients play a role along with decreases in physical activity due to the sedentary nature of work, modes of transportation becoming modernized and increased urbanization. Major dietary change includes a large increase in the consumption of fat and added sugar in the diet, often a marked increase in animal food products contrasted with a fall in total cereal intake and fiber [63]. Furthermore, unrefined sugars, starches and carbohydrates have been replaced with their industrially refined equivalents which may further worsen the health status of individuals including a significant rise of heart disease and type 2 diabetes [64]. As shown in **Figure 17**, while Africa remains low on the consumption of animal sourced proteins as compared to the US, Western Europe and Australia, there are some countries within Africa that consume more animal products particularly Sudan and Somalia (pastoralist based systems), North Africa and Southern African transition countries [62]

Figure 17: Consumption of Animal Sourced Products Measured by Calories/Day Globally [62]



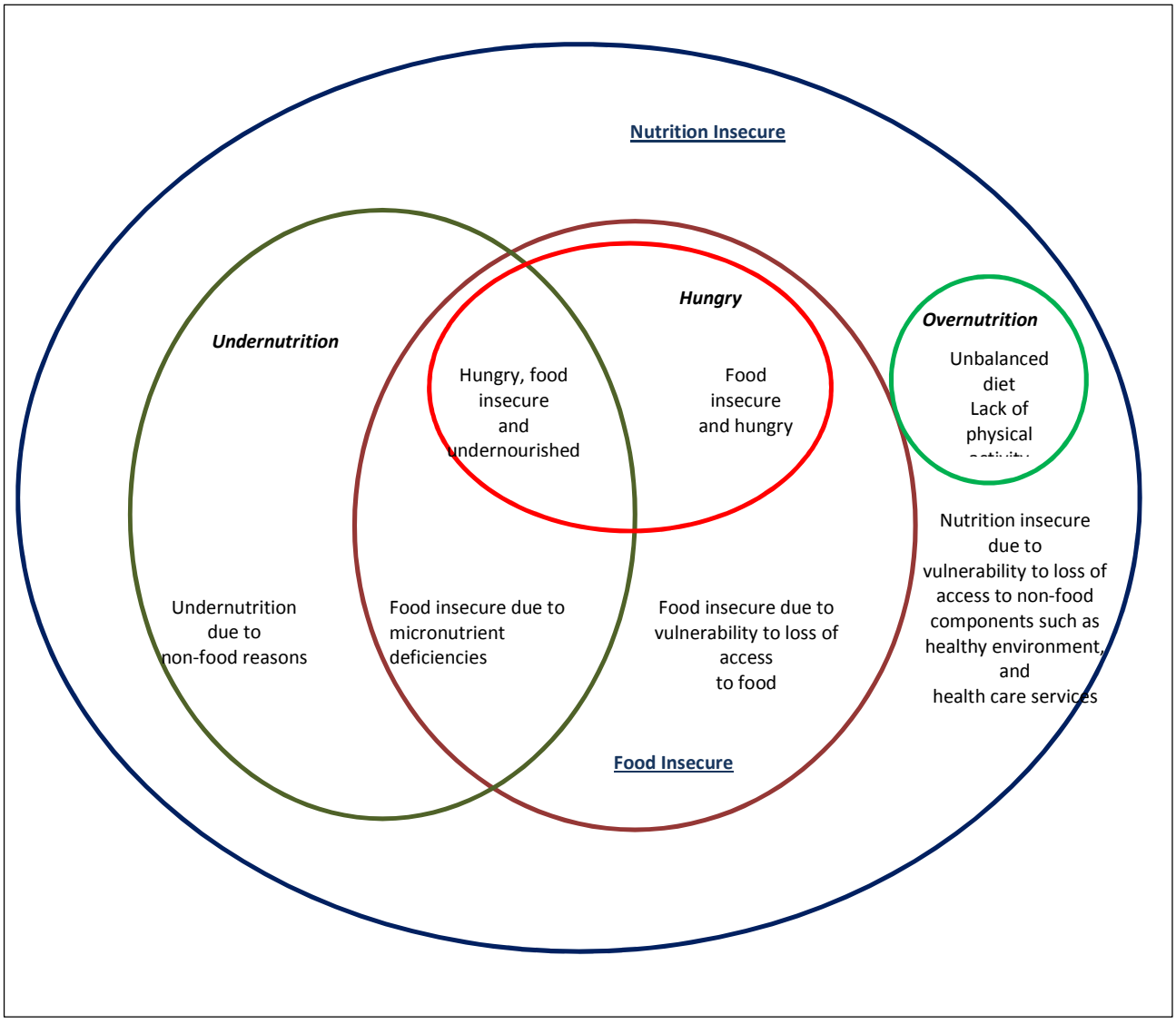
Putting the pieces together – the idea of nutrition security

From the definitions and situational analysis of Africa provided above, a better defined idea of food and nutrition security can be visualised. **Figure 18** demonstrates this [65]. The larger circle of the figure represents a nutrition-insecure population in which overnutrition, undernutrition and hunger fit within. The various internal circles and their overlaps represent households or individuals who are suffering from various forms of nutrition inadequacy and food insecurity. Nutrition security is a multidimensional phenomenon,

requiring secure physical, economic, social, and physiological access to adequate and nutritious food, a sanitary environment, adequate health services, sufficient safe water and fuel used for cooking, adequate food preparation capabilities and knowledgeable care.

Although nutrition security is principally defined at the household and the individual levels, as with food security, the determinants of nutrition security extend far beyond the control of the household itself. Nutrition security involves many institutions, sectors – particularly health, education and agriculture, and other actors than those typically found in the food sector. It is unlikely that a food or agricultural strategy alone will bring about the desired end to nutrition insecurity, particularly when implemented or functioning in separate worlds from health and education for example, with different goals [65].

Figure 18: A Broader Notion of Nutrition and Food Security (IFPRI 2004)



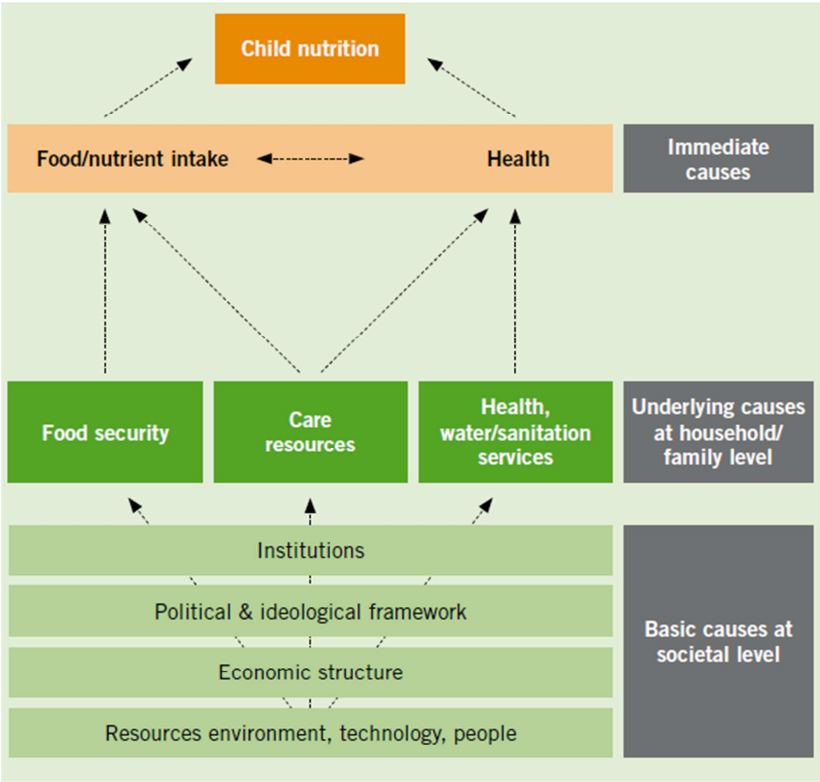
2. Understanding the Determinants of Malnutrition

The determinants of malnutrition

Poor nutrition arises from multifaceted and interrelated circumstances and determinants. **Figure 19** illustrates the accepted model of causes of malnutrition, from immediate to underlying causes [66]. The immediate causes – inadequate dietary intake, water and sanitation and related diseases, lack of necessary knowledge – directly affect the individual, with disease perpetuating nutrient loss and poor nutritional status. Even without disease burden, children with inadequate nutrient intake will not grow sufficiently and are at risk of irreversible stunting [67-69].

An individual's nutritional status can be affected by circumstances within the household and the community as well. These more intermediate causes include household food insecurity through agricultural production and income, inadequate care for children and women, unhealthy household environment and lack of accessible health and education services. Underlying these causes are longer-term, more complicated determinants such as poverty as a major factor, along with gender inequalities, and larger political, economic, social and cultural environments which affect institutions and leadership from the community to national level.

Figure 19: Framework of Determinants for Child Nutrition [66] [42]

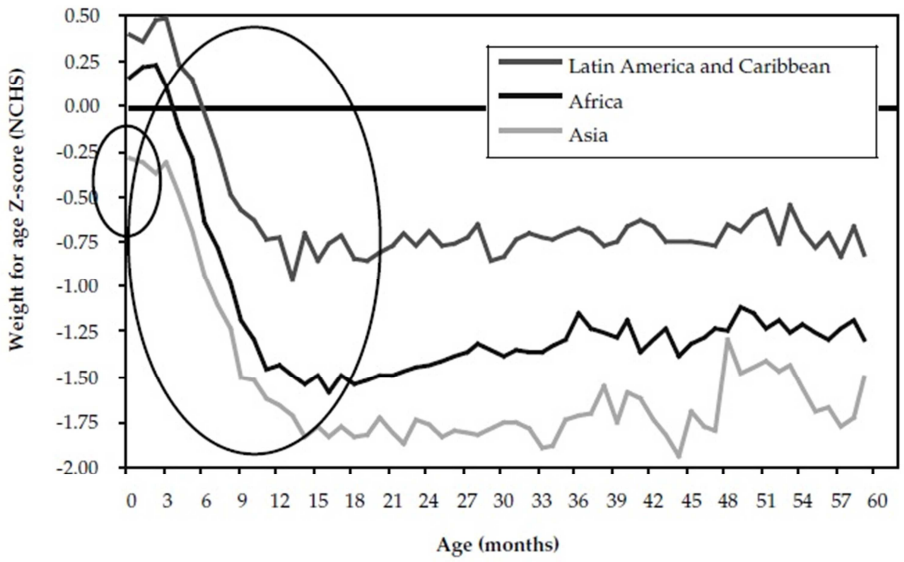


The first one thousand days of life

With the growing impetus to end malnutrition, an emphasis on the first 1,000 days of life — a window of opportunity for health and development – has become central. The process often starts in the womb and continues through at least the first two years of life. The periods of pregnancy and lactation and the first two years of life pose special nutritional challenges because these are when nutrition requirements are greatest and when these population subgroups, in Africa in particular, are most vulnerable to inadequate caring behaviors, inadequate access to health services, and inappropriate feeding practices [70].

Young children need adequate dietary intake (through exclusive breastfeeding followed by quality complementary feeding) to support the rapid rate of growth that occurs in the first two years of life. Inadequate feeding and care practices often lead to a rapid decline in nutritional status after birth, and more prominently after 3 to 4 months of age (when typically other foods beyond just breastmilk are introduced). **Figure 20** demonstrates that growth in children drops dramatically during this early time period in all regions of the world, with Africa being the second most severe after Asia [68].

Figure 20: Growth Faltering in the First Year of a Child's Life by Region [68]

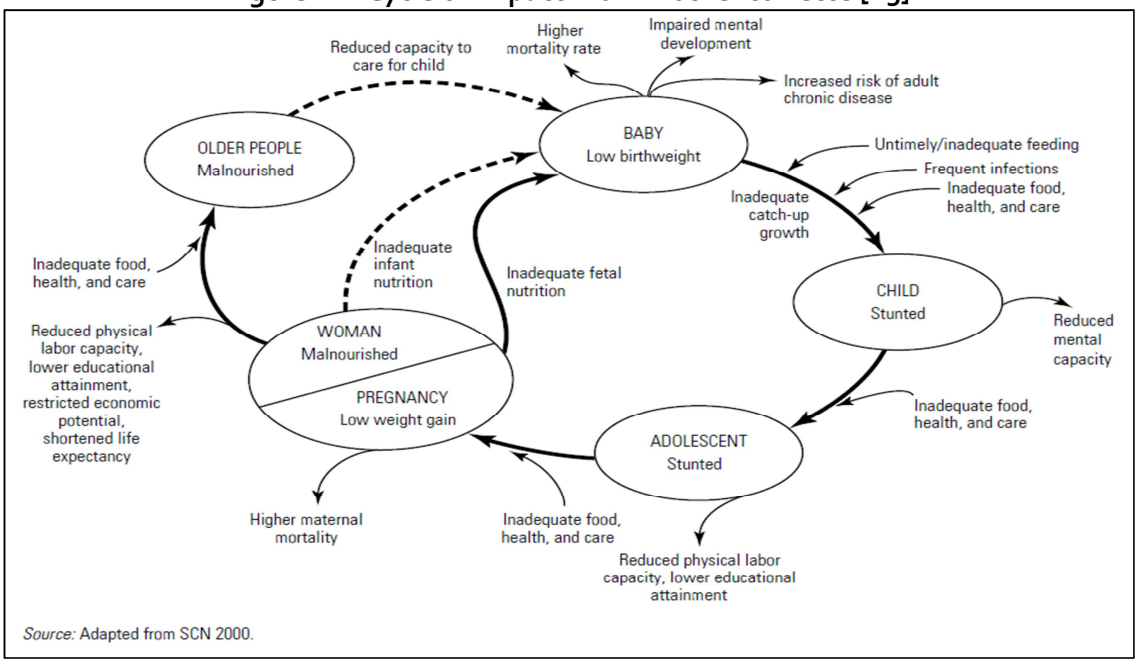


Data also show that the damage done by undernutrition very early in life, to both physical growth and brain development, is largely irreversible [71]. Growth during this time is episodic rather than continuous and may alter the path of later growth and disease risk. Growth faltering at 2 years of age, for example, may induce adiposity at an early age in childhood leading to childhood obesity [72]. Chronic diseases, including cardiovascular disease and type 2 diabetes, have been associated with the "path and tempo" of growth during the window. The same disease may originate through more than one path of growth [73].

Height has been shown to be related to adult productivity [74] and final height is determined in large part by nutrition from conception to two years of age (the window). A one percent loss in adult height as a result of childhood stunting is associated with a 1.4% loss in productivity [75]. Growth failure before the age of two, anaemia during the first two years of life, and iodine deficiency in the womb can also have profound and irreversible effects on a child's ability to learn [79]. Vitamin and mineral deficiencies in the womb and in early childhood can cause blindness, dwarfism, mental retardation, and neural tube defects—all severe handicaps for human and country development, but particularly limiting for growth in Africa [70]. For example, anaemia has a significant impact on productivity in adults. Eliminating anaemia leads to a 5 to 17% increase in adult productivity, which adds up to 2% of GDP in the worst affected countries [76] [77, 78].

Malnutrition can continue from generation to generation in a cycle driven by poverty as shown in **Figure 21**. A child born to a mother that is undernourished will likely be born with low birth weight and has increased risks of high morbidity and mortality. If the infant survives, and the mother is not able to care for the child or adequate, quality food is not available or accessed, her growth will be impaired resulting in stunting, poor cognitive abilities and increased susceptibility to infectious diseases, and later in life, to non-communicable diseases. As the child grows, her chances of escaping this nutrition-poverty trap diminish. Stunting can be irreversible, and the options for better education attainment and delaying marriage decrease [68]. She will in turn, give birth to a baby of low birth weight, and the cycle begins again. This cycle must be broken and it all begins with the mother or more importantly, adolescent girls to get them on the right track for when they themselves become mothers [65].

Figure 21: Cycle of Impact From Mother to Fetus [65]



Source: Adapted from SCN 2000.

Young women, maternal and child undernutrition remains one of Africa's most fundamental challenges for improved human development and sustained economic growth. Because undernutrition is intricately linked to morbidity and mortality, the punishing undernutrition, that begins with mothers, is unrealized human potential [21].

After the first 1000 days: nutrition based poverty traps and the determinants of malnutrition

Poverty is the major root cause of maternal and child malnutrition, as shown in **Figure 19**. Of course, this has devastating human development consequences from generation to generation, and can seriously impede the growth of nations. Poverty based on the links between nutritional status and productivity can be dynastic: once a household falls into a poverty trap, it can prove especially difficult for descendents to emerge out of it, even if the economy in the aggregate were to experience growth [80]. In sub-Saharan Africa, even if well-governed, is stuck in a "poverty trap"- too poor to achieve high levels of economic growth and in some areas, too poor to grow at all [81]. There are interactive factors that cause this trap, with nutrition and food insecurity being significant.

Nutrition based poverty traps are resurfacing as an important issue in achieving nutrition security for Africa, and calls for multi-sectoral approaches. Banerjee and Du Flo describe these traps in which "there exists a level of nutrition, above or below which dynamic forces push people either further down into poverty and hunger or further up into better-paying jobs and higher-calorie diets. These virtuous or vicious cycles can also last over generations: early childhood under-nutrition can have long-term effects on adult success. Maternal health impacts in *utero* development. And it's not just quantity of food – quality counts, too. Micronutrients like iodine and iron can have direct impacts on health and economic outcomes" [82].

Malnutrition constrains the ability of people to fill their potential to the fullest. Hunger and undernourished persons are not able to take on physical work, are less able to attend school and if they do, are less able to concentrate and learn. Diet related chronic disease takes many out of the workforce completely and they become a major burden on the public health service system [83]. Micronutrients for example, are needed for human growth and development. When deficient, they damage health, harm reproduction, reduce intelligence and academic achievement, increase mental impairment, and lower work productivity and occupational choices. This impaired development, is often permanent [84].

For Africa, addressing poverty with a goal to improve nutrition is as essential as addressing the shorter and intermediate determinants including health and infectious disease, education, gender and food security.

Health and infectious diseases as determinants

The immediate causes of malnutrition, health and diseases are household food security, personal health, primary health care services, and the psychosocial care environment – which have synergies that impact each other as shown in **Figure 19**. As discussed earlier, household food security, in both quantity and quality and the ability to utilize foods is an

important determinant. The ability to access primary health care including issues such as distance, affordability and quality of care can have implications on nutritional outcomes. Access to health services and environmental health conditions relate to the access to essential drugs and immunizations, safe water, and sanitation and hygiene. Insufficient or delayed treatment also prolongs disease occurrence and severity [66, 85]. Poverty, poor hygiene, lack of knowledge, no access to water supplies, poor housing and health services, cultural practices and discriminatory social structure often occur together, and these create an environment of poor nutrition and susceptibility to infectious diseases [86].

Food supply, underlying health, and health care interact in important ways, and their combined effect is synergistic. The underlying causes may also change depending on the seasons and geographic influences. Rural households, for example, may experience an annual hunger season whereas impoverished urban areas may experience high levels of poor sanitation. Diarrheal diseases and malaria are more prevalent during rainy seasons, and respiratory tract infections are more prevalent during cold weather [85].

Malnutrition is one of the primary causes of immunodeficiency worldwide, particularly for infants. There is a strong relationship between malnutrition and infection and infant mortality, with poor nutrition leaving children underweight, weakened, and susceptible to infections [86]. Not only does malnutrition put a child at risk to infections but infections also contribute to the symptoms of malnutrition, causing a vicious cycle. Inadequate dietary intake both in quantity and quality can lead to weight loss, lowered immunity, mucosal damage, invasion by pathogens, and impaired growth and development in children [85]. A sick person's nutrition is further aggravated by diarrhea, malabsorption, loss of appetite, diversion of damage to defense mechanisms. These, in turn, cause reduced dietary intake [87].

Water and sanitation as determinants

Poor water and sanitation has been associated with increased risk of infections in children [88, 89] and increased malnutrition [90]. Conversely, improved water and sanitation has been associated with lower risk of malnutrition [89, 91]. In sub-Saharan Africa, the burden of disease attributable to malnutrition is 32.7% and to poor water and sanitation 10.1% [92]. Thus, improved access to safe water and sanitation may have enormous potential to reduce the burden of disease for the continent. A study done in Sudan demonstrated that water and sanitation are independently associated with improved growth of children, in particularly, stunting [93].

There has been suggestions that tropical enteropathy is caused by faecal bacteria ingested in large quantities by children living in conditions of poor sanitation and hygiene. If toilets were available, and handwashing was promoted after faecal contact, tropical enteropathy could be reduced and prevented, and impact growth outcomes [94]. Food and water can also be sources of infectious agents [87] thus, increasing knowledge and improving practices of safe handling, storage and cooking of foods and beverages is important to reduce risk.

Improved sanitation and hygiene can significantly reduce the incidence of diarrhoeal disease [95, 96]. To make significant changes in stunting rates in Africa, access to clean water and improvements in sanitation and hygiene will be essential. It has been estimated, at least for Africa, that 85% of the burden of disease preventable by water supply is caused mainly by diarrhoeal diseases that often results in child mortality [97].

Education as a determinant

Nutrition has been shown to be important for cognitive achievement and school enrollment and completion. Women's educational attainment is a key factor in preventing infant undernutrition and educational attainment is essential in escaping poverty [98] [99]. Strong associations are found between the stunting of children under two, neonatal malnutrition and their cognitive ability [100-103]. In Ghana for example, a 10% increase in stunting causes a 3.5% increase in age of first enrollment at school [104].

Girls are less likely to be enrolled in school compared to boys and if they are, tend to drop out earlier than boys. Girls are more likely to have tasks that prevent them from attending school, for instance, household chores and caretaking of younger siblings or sick members of the family [105]. Malawi has one of the highest school dropout rates in southern Africa, with 15% of girls and 12% of boys dropping out in primary school. In some countries, sociocultural norms also dictate that girls marry during adolescence and have their first child soon thereafter, which has implications on their own ability to give birth to a healthy child, thus limiting the ability to break the cycle discussed above. These constraints often limit the ability for women to improve not only their own nutritional status, but that of their children's.

School meal programmes that target primary school age children will not impact the window of opportunity to improve nutrition but could provide an avenue to better nutrition by keeping girls in school to reach their educational attainment. School meals often act as a social safety net following shocks and crises which often lead to increasing number of out-of-school children and reduced spending on education [106]. School meals also provide long-term educational benefits through alleviating short-term hunger, promoting attendance, improving concentration, and promoting learning [107, 108].

Gender as a determinant

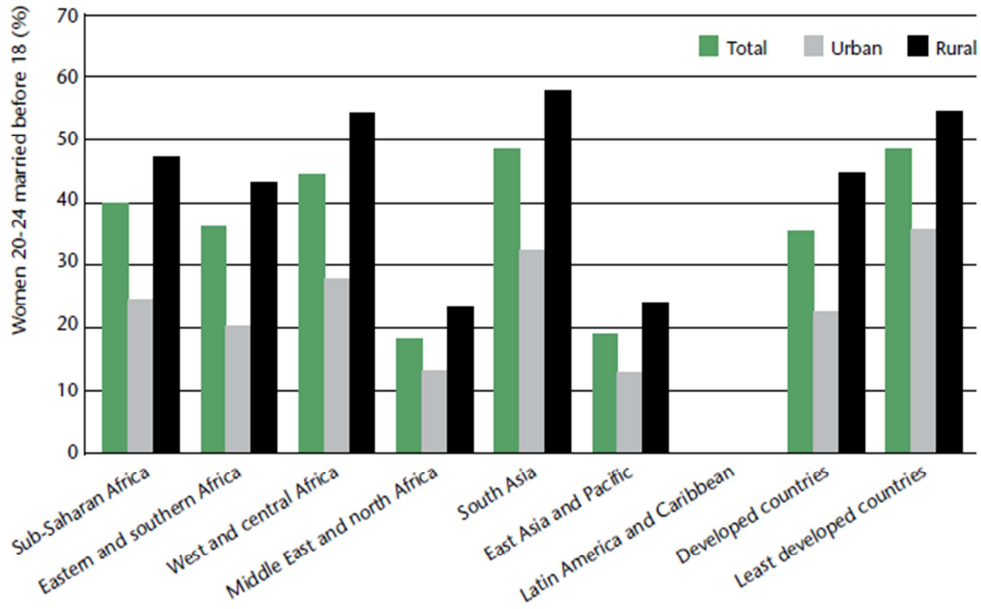
Improvements in the nutritional status of women and girls will contribute to reducing gender inequality while at the same time, breaking the cycle of impact on intergenerational malnutrition. Gender empowerment is an essential part of human development and for improvements in nutrition across the entire life cycle [109]. In unequal conditions, women and girls have poorer nutrition outcomes throughout the life cycle, higher rates of mortality, less access to health care, and greater household food insecurity [110]. Maternal mortality and malnutrition has been correlated with low value of gender development index and female to male literacy ratios [110] and studies have shown that improvements in education of women specifically have contributed to a reduction in child malnutrition of more than 50% from 1970 to 1995 [111]. Furthermore, women's decision–making power relative to men's has been significantly associated with improved nutritional status in their children [112] .

Adolescent and child marriage continues to be a strong social norm in the developing world, particularly in Central and West Africa [113]. As shown in **Figure 22**, 40% of women are married before the age of 18 with rural areas having higher prevalence of early marriage. The prevalence of early marriage is highest in central and western Africa. Delaying marriage is associated with lower incidence of low birth weight of children born in Africa. The incidence of low birth weight is decreased and the median age at first marriage is higher. In southern Africa, median age at marriage is higher (in Botswana, Namibia, South Africa and Swaziland, between 23.7 and 24.3 years), compared to the mean of 18.7 years, but the low birth weight rate is similar to the African mean [54]. As shown earlier, with intergenerational cycle of malnutrition, infant girls are born with low birth weight, experience growth failure when young, and become small adult women who subsequently repeat the cycle by having their own low-birth-weight babies.

By improving newborn birth weights, child growth faltering can be reduced in the first two years of life, and into adulthood. Improved cognitive function and intellectual development are associated with an increase in birth weight and reduction in stunting. The negative effects of lower birth weight on intellectual development are accentuated in lower socioeconomic groups, and can be mitigated by improved nutrition, health care and home environments [54].

The associations between low birth weight and age at marriage are most likely influenced by confounding factors such as poverty, health environment, or women's education. This does however imply that longer term determinants of malnutrition which include addressing gender empowerment need to be addressed. This includes keeping girls in school and implementing laws to prevent under-age marriage. Postponements of first pregnancies until an adolescent girl or young woman is fully matured have significant benefits for the health of both mother and child. Indeed, this could be a crucial factor in breaking the intergenerational cycle of malnutrition, and accelerating the progress towards the normal growth and development [54].

Figure 22: Child Marriage Rates by World Region and Urban and Rural Areas (UNSCN 2011)



Agriculture as a determinant

Throughout Africa, massive challenges persist, with 60% of rural populations living on less than $1.25 a day [114] and a huge proportion of the population resides in landlocked, resource-scarce countries [115]. Tropical Africa, is essentially stuck in a poverty trap—too poor to achieve robust and high levels of economic growth, and in many places, simply too poor to grow at all due to high transport costs and small markets, low productivity agriculture, high disease and malnutrition burden, adverse geopolitics and slow adoption of technology from abroad [116]. North Africa (Algeria, Egypt, Libya, Morocco, and Tunisia,), southernmost Africa (Botswana, Lesotho, Namibia, South Africa, and Swaziland), and a number of very small economies (Cape Verde, Comoros, Djibouti, Equatorial Guinea, Gabon, The Gambia, Guinea-Bissau, Mauritius, São Tomé and Principe, and Seychelles) are the "non-tropical ends of Africa that are considered much more wealthy than sub-Saharan Africa. These regions grow temperate crops, escape the worst of infectious disease burden such as malaria (there are exceptions such as HIV/AIDS), are rich in mineral deposits such as gold and diamonds and are in close proximity to EU markets [117].

In many countries within Africa, agriculture remains the backbone of the rural economy. Increasing agricultural outputs impacts economic growth by enhancing farm productivity and food availability [118], while providing an economic and employment buffer during times of crisis [33]. Over the past decade, decreasing levels of agriculture aid and investment in Africa, particularly the dismantling of input, credit and market subsidies,

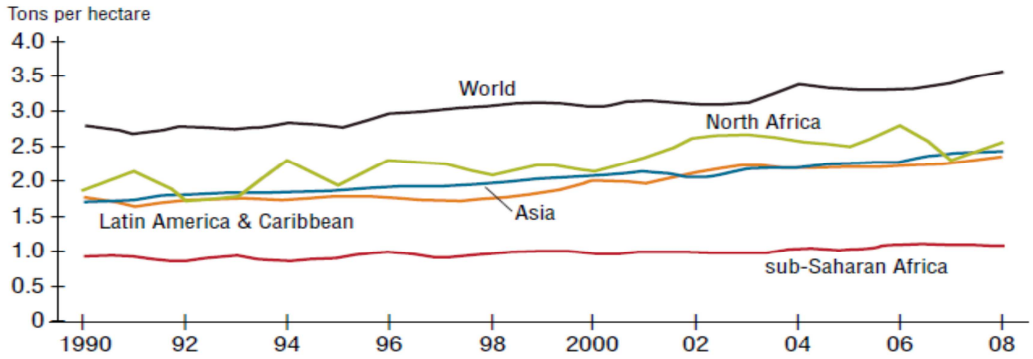
reduced public support to research and extension, and declining infrastructure investments have been linked to rising numbers of people being undernourished [33]. The reverse relationship has also been suggested, with hunger and undernourishment carrying substantive economic and social costs with reduced labor productivity, investment in human capital, and escalating poverty [70] [119] [120].

At least half of the world's food insecure are poor, smallholder farmers living in low-income countries cultivating on marginal lands without access to productivity-enhancing technologies or markets to engage in commercial agriculture [121]. These farmers, most living on less than 2 hectares, must produce the food they need for their own survival [122], and for the most part, are net buyers of food. Small farms provide over 90% of Africa's agriculture production [123] and women produce 60-80% of the food that is consumed locally in developing countries [124]. Rural production of food is a major economic driver for Africa with 63% of its population living in rural areas.

Food production in Africa, to feed Africa, is still an issue. Many in Africa live in rural areas trapped in a combination of low-productivity agriculture, poor health, and undernutrition. The slow progress in SSA and the difference in the starting point are also clear in **Figure 23** that shows changes in cereal yield from 1990 to 2008. As **Figure 23** demonstrates, sub-Saharan Africa's cereal production has lagged behind the rest of the developing world's production. Africa has the highest proportion of rural poor and the greatest potential for smallholder agriculture led poverty reduction [125]. Smallholder farming is the dominant mode of agriculture in sub-Saharan Africa with 80% of its farms comprising of 2 hectares or less. However despite the rich natural resources and food diversity, agricultural growth has not kept up with population growth, and its productivity largely falls behind other regions such as Asia as shown in **Figure 24**. Some countries such as Mozambique and Nigeria have not increased their food production levels enough. The agricultural sector in Africa consists mainly of rain-fed, low-technology, low-input, non-mechanized smallholder farming [114] and food production has been insufficient largely due to conflict, natural disasters, crop failure and food prices. Twenty one of 30 sub-Saharan African countries were in need of external food assistance last year [1].

In 1961, average cereal yield in sub-Saharan Africa was very low at 0.8 tonnes per hectare [1]. In 2000, this was 1.14 tonnes per hectare, in 2009 this was 1.38 tonnes per hectare [1]. Even if cereal yields would have been doubled since 1961 in sub-Saharan Africa, they would still be around 1.6 tonnes per hectare –very low compared to cereal yields in Asia at 3.6, South America at 3.4, and the US at 7.2 tonnes per hectare [1]. One significant change is the production of roots and tubers which has gained in relative importance over the years as compared to other crop groups. **Figure 25** demonstrates the high production yield of cassava and yams in Africa as compared to other crops.

Figure 23: Cereal Production of Different Regions (1990 to 2008) [126]



Source: USDA,Economic Research Service using data from Food and Agriculture Organization of the United Nations, FAOSTAT database.

Largely, agriculture research, programs and policy have not focused on maximizing nutrition output from farming systems and many agriculture interventions have failed to improve nutrition outcomes [127]. While agriculture remains the backbone of the rural economy and increasing agricultural outputs impacts economic growth by enhancing farm productivity and food availability, the emphasis has been mainly on food production and less on nutrition security. Good health, nutrition and productive agricultural systems that do not deplete natural capital are essential in the fight against poverty and are all needed to achieve food security and indeed the wider Millennium Development Goals [128].

The interactions between health, nutrition and agriculture are mutual: agriculture affects health and health affects agriculture – both positively and negatively [129]. If agricultural production systems are poor, there can be negative effects on health, whereas strong production systems can improve health of communities. Similarly, poor health can limit agricultural productivity but improved health and nutrition allows for improvements in agriculture outputs [129]. Joint action in agriculture, health and nutrition could have benefits for food security and development and could substantially reduce risks for the poor as well as improving women's status, improving incomes for the purchase and demand of higher quality foods as consumers, and mitigation of food prices crises [119, 130]. It is also clear that agriculture plays enormous roles across social, economic and environmental spheres as well as shown in **Figure 26**.

Figure 24: Cereal Production in Asia versus Africa (1990 to 2007) [1]

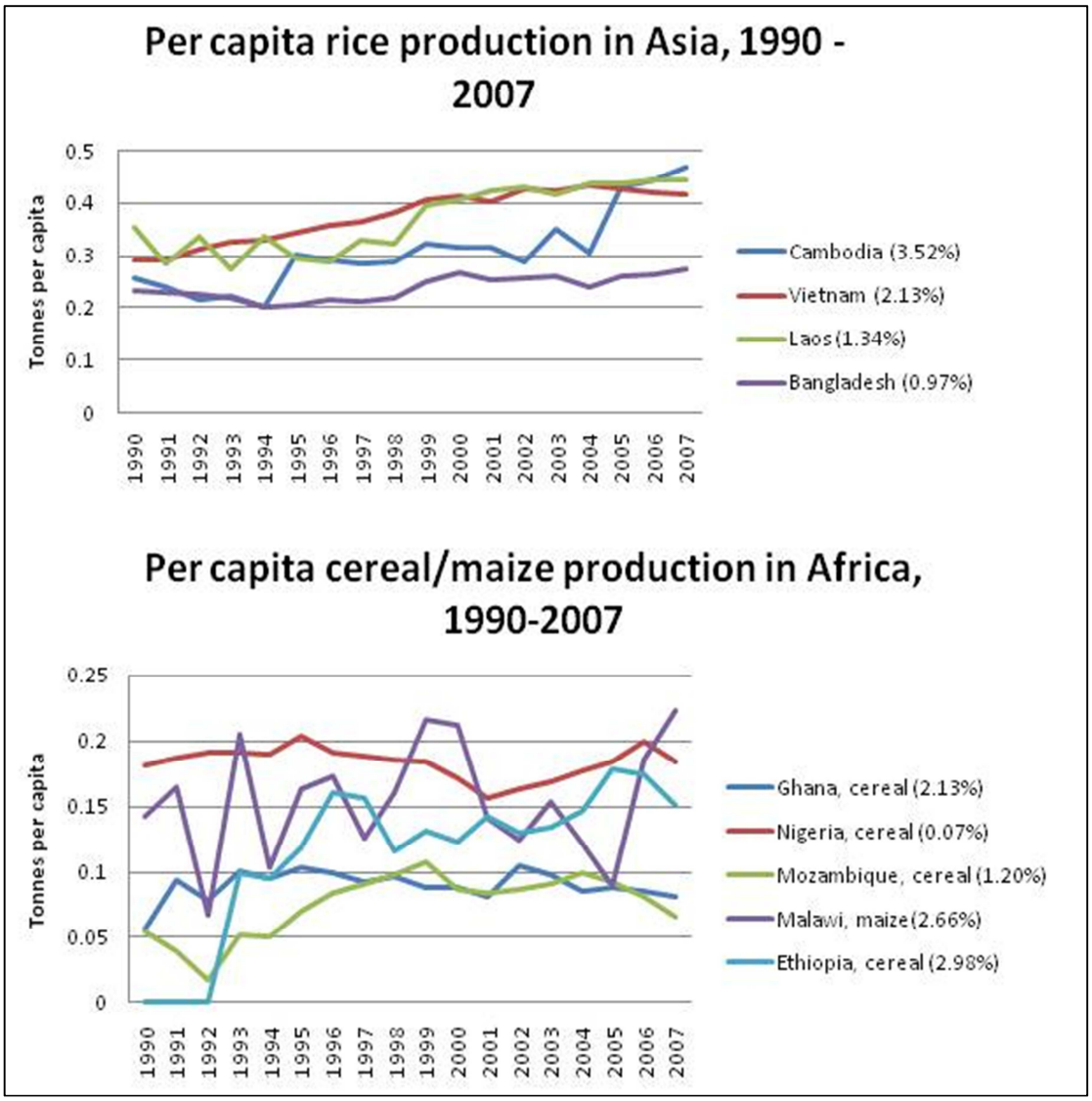


Figure 25: Staple Production of Foods in Africa [1]

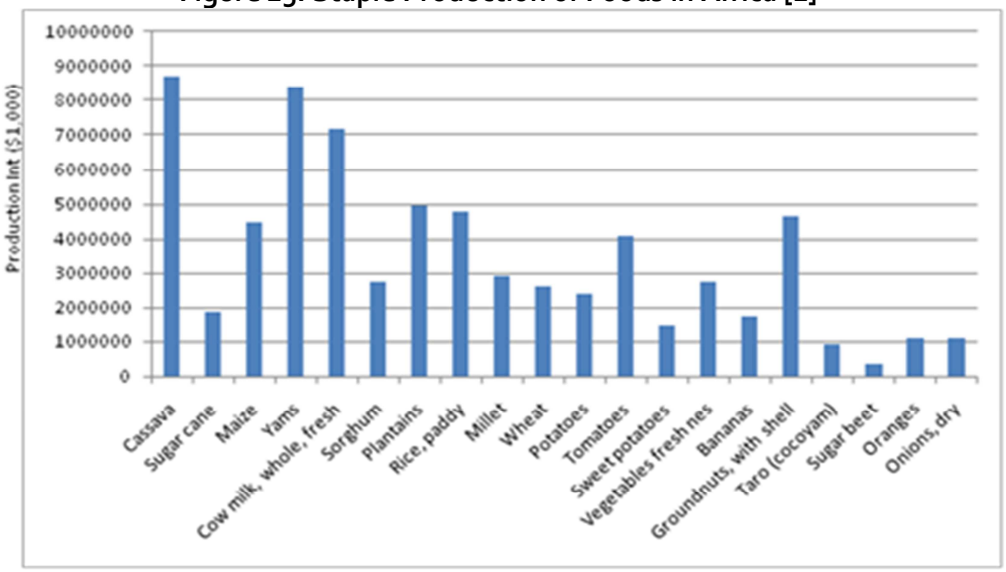
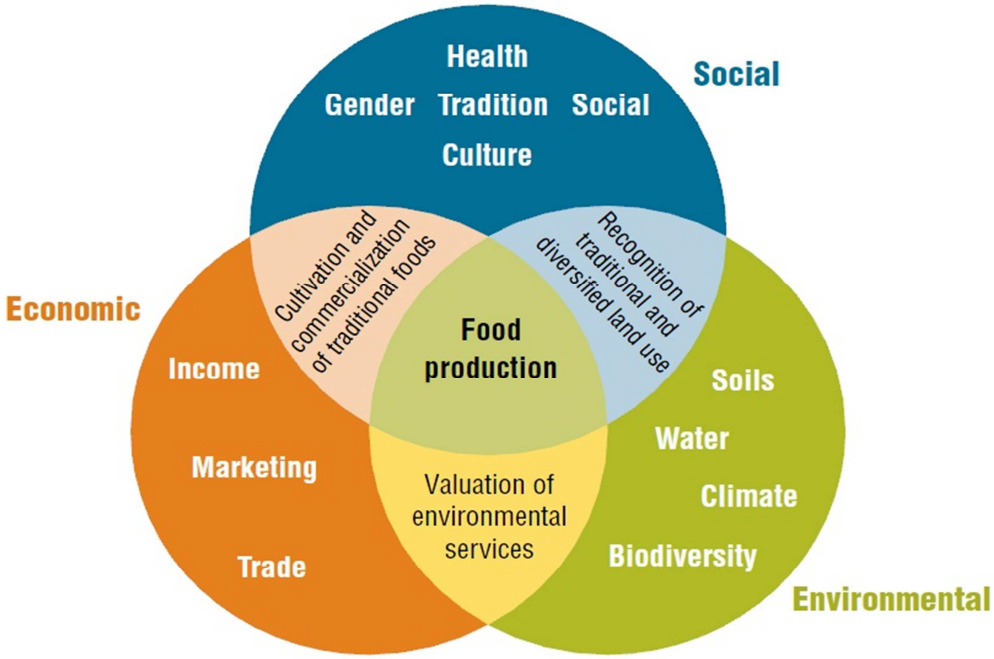


Figure 26: The Significant Roles of Agriculture [126]



The global agriculture system is currently supplying the world with more than enough food, in aggregate. However a sufficient and stable access to food is often impossible to achieve for populations living in Africa. Furthermore, the quality, variety and nutritious value of food have been distorted due to an emphasis on the production of a handful of crops, mainly staple grains and refined sugars. This is problematic for populations at risk of undernutrition such as Africa, as well as those at risk of obesity and related diseases. In developing countries and particularly those in nutrition transition such as South Africa, Egypt, and Tanzania, people obtain most of their energy from these refined staples along

with processed oils and fats and refined sugars, resulting in diets that often lack micronutrients and other necessary dietary components such as fiber.

It will be crucial to better understand if and how Africa's agricultural system can improve nutrition security. Big driver of trends in food consumption in Africa alone are the private sector, informal and formal markets, processed food and diet shifts. Innovative and sustainable approaches to improve the quality and variety of food produced around the world are being developed. Such innovations include biofortification (e.g. orange fleshed sweet potatoes in Mozambique and Uganda), food fortification (e.g. micronutrient powders for complementary foods), and usage of agricultural biodiversity (e.g. Kenya's traditional leafy green vegetables). Agriculture- based approaches to improving diet diversity and nutrition are not straightforward and many potential solutions are in the research pipeline. Furthermore, the role of food industry and private sector will be crucial in influencing what quality foods get to market and improving nutrition along the value chain.

The implications of diet diversity and diet quality on nutritional outcomes

The quality of the diet is particularly important for reducing stunting in children because inadequate nutrition causes physical, cognitive, and immunologic deficits [131, 132]. Particularly when experienced during the first 1,000 days of life (pregnancy and up to 24 months of age), nutritional setbacks can result in irreversible losses to growth and cognitive potential, and reduce educational attainment and earning potential as well as dramatically reduce the quality of the workforce at a national level [69, 73, 133]. Dietary intake must be diverse, including a diversity of plant and animal-source foods, to ensure an adequate intake of essential amino acids and fatty acids, macronutrients, and micronutrients necessary for growth, development and overall health for young children. Inadequate nutrient intake can have multiple causes including:

- not having access to a variety of quality foods (due to affordability, availability in markets, lack of production or social limitations);
- not utilizing that variety to get the most nutrition from the foods due to poor cooking practices, unsafe water, anti-nutrients (see **Text Box 2**) and storage or poor immune status;
- not consuming high-quality diets because of food traditions or taboos; or
- not having the knowledge of how to improve diets or adequately prepare and store foods in order to ensure they are meeting nutritional needs.

With plant foods being a dominant source of the diet in much of the poor world, anti-nutrients and promoters contained in these plant foods should be taken into consideration with regard to bioavailability of nutrients to humans. Most anti-nutrients in foods inhibit the absorption of micronutrients that are essential for growth and often deficient in the developing world – predominantly iron and zinc. Anti-nutrients include phytic acid, fiber, tannins, axalic acid, goitrogens and hemagglutinins [134, 135]. Phytic acid or phytates, one of the greater concerns, are often found in whole legumes, and cereal grains – the staples of the diets in resource-poor communities.

Not only is it essential that nutrients are absorbed from foods consumed, but that the composition of the foods consumed in specific combinations completes dietary needs. The role of essential nutrients in human health and the synergies in their physiologic functions are increasingly recognized and support the notion that nutrient deficiencies rarely occur in isolation [136]. The challenge is to provide the adequate amount and diversity of nutrients required for a complete human diet.

Text Box 2
BIOAVAILABILITY AND ANTI-NUTRIENTS
Several traditional food processing and preparation methods are often used at the household level to enhance the bioavailability of micronutrients including mechanical processing, soaking, fermentation and germination or malting[5]. For example, boiling of tubers can induce moderate losses of phytic acid[8]. Fermentation can also induce phytate hydrolysis via the action of microbial phytase enzymes which hydrolyze phytate to lower inositol phosphates[14]. This has been done in maize, soy beans, sorghum, cassava, cocoyam, cowpeas and lima beans, all common foods in the developing world. Low-molecular weight organic acids such as critic acid can increase fermentation and enhance the absorption of zinc and iron[18].

Challenges beyond the "Core Determinants"

Urbanization

Africa has the highest urban growth rate of all world regions at 5% per year [137]. On average, the population of the Africa Region is now one-third urbanized, higher than South Asia's 28%. Africa is approaching a demographic inflection point as the numbers of new urban residents are projected to rise sharply by over 300 million between 2000-2030—more than twice the rural population increment [138]. Urban poverty rates are quite close of the rural rate of 20% in Kenya, Malawi, Mozambique and in two of the most populous countries, Ethiopia and Nigeria. The magnitude of urban poverty amounts to a third or more of the urban population in the first four of these countries as well as in Madagascar, Niger, Senegal and Zambia [138]. Rapid urbanization will severely impact nutritional outcomes for years to come if governments cannot provide adequate livable solutions for the urban poor and if local to regional food systems do not allow for access to healthy food choices. This also could pose as a great opportunity to ensure that rural farmers are better linked to produce and market quality foods for the growing demands of city dwellers.

HIV/AIDS

Perhaps a major factor draining some of Africa's development impetus is the affliction of HIV/AIDS. The epidemic is due in part to some of the reason why Africa's hard-won investments in human capital and other assets, including administrative capacity, become underutilized and degraded [138]. Africa remains the region most affected in the world by AIDS and is home to two thirds of all people living with HIV worldwide, with 72% of all AIDS deaths [139]. Southern Africa is the most severely impacted with Swaziland and South Africa having the largest burdens [140]. However, West and Central Africa have much lower levels than southern Africa and specific countries such as Uganda, with political commitment and focused programming, have stabilized the growing epidemic.

One of the basic causes of the epidemic of HIV for sub-Saharan Africa, is food and nutrition insecurity [141]. Agricultural systems and food supply failures can greatly impact food due to shifts in the labor market (both demographic and migration to urban centres), land tenure rights, and lack of labor saving incentives for example [142]. An increasing body of

evidence has also demonstrated the links between malnutrition, HIV, and AIDS and the cumulative effect they have on economic growth [143]. Adequate nutrition is necessary to maintain the immune system, manage opportunistic infections, optimize response to medical treatment, sustain healthy levels of physical activity, and support optimal quality of life for a person living with HIV. Good nutrition may contribute to slowing the progression of the disease [144].

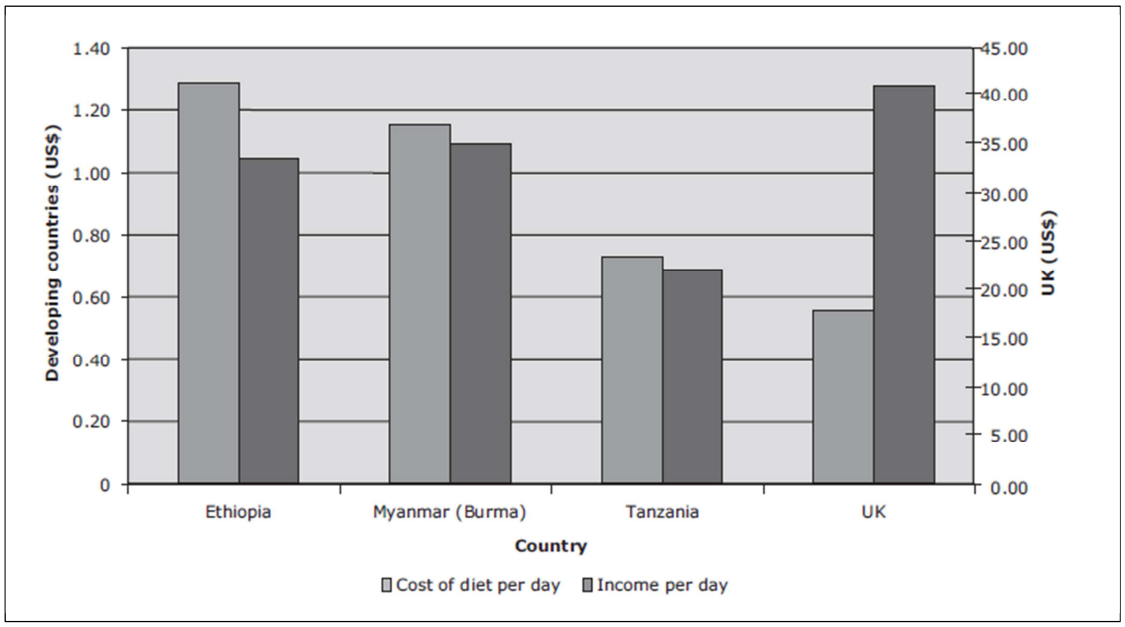
Food Prices

Lastly, the increased food prices will remain a pivotal issue in undermining food security and the livelihoods of the poor. Food price increases in both 2007-2008 and 2010-2011 and reduced investment in agriculture could push 16 million more children into malnutrition in 2020 compared with continued economic growth and maintained investments [145]. African countries have reacted by stockpiling grain, particularly in the Horn of Africa, imposing price controls, waiving tariffs, and banning export contracts. However, not everyone is affected due to good harvests in some countries and high global cereal stocks.

Children are often the most vulnerable and impacted by such crises. Because children's undernutrition affects their physical and cognitive development and has implications for their earnings as adults [146], the food price crisis could have long-lasting negative implications for people's livelihoods and economic prospects long after prices come down [41]. Although some donor governments have increased aid, this will not be enough to meet rising needs for protecting the most vulnerable with the food price increases. Where foreign aid budgets are cut, even greater pressures are placed on health and education systems as well as social protection services [41]. Social protection strategies should be ensured throughout Africa to mitigate the current shock for the most vulnerable including women and children, and at the same time prevent future negative impacts. Nutrition interventions, such as school feeding and programs for improved nutrition for young children and pregnant and lactating mothers should be implemented and expanded to ensure universal coverage[42] [147].

The income generated within poor households is often not enough to afford the cost of a nutritious diet, particularly given that not all of a household's income is spent on food with the poorest spending 70 to 80% on food [19, 132]. This situation is amplified during times of food price increases as we have seen globally in 2008 and again in 2011. An analysis on the costs of diets, using a linear programming tool developed by Save the Children UK, demonstrate that in countries such as Ethiopia and Tanzania, the cost of the diet exceeds the income earned per day (**Figure 27**). Although agriculture could play a role in producing better quality food, and adequate health care could reduce disease risk, without mechanisms for households to access, consume and utilize nutritious foods, these efforts are ineffective. This also demonstrates that social protection programmes, such as food safety nets, cash transfers and food vouchers, are important to filling this cost gap.

Figure 27: Average Daily Cost of a Diet and Daily Income in Poor Households (de Pee et al 2010)



3. What is being done to Address Malnutrition and Food and Nutrition Insecurity in Africa?

Interventions being scaled to address the malnutrition burden and their appropriateness for the continent

There has been a major refocus over the last several years on the importance of nutrition in human development with a particular focus recently on the "critical window of opportunity, "the first 1000 days of a child's life from the 9 months *in utero* to 2 years of age [68, 133].[2] This window influences child growth, nutritional status, and cognitive development. For children who survive early childhood malnutrition, the physical and cognitive setbacks are lifelong, leaving children more vulnerable to chronic illness throughout their lives and reducing productivity, earning potential and overall development. Core interventions that impact this window (shown in **Figure 26** to address immediate causes) currently being promoted for global scale-up can be broadly grouped into those that aim to:

- Promote good child feeding and hygiene practices;
- Provide micronutrient supplementation for young children and their mothers;
- Support the provision of micronutrients through food fortification;
- Treat acutely malnourished children with therapeutic feeding.

[2] See http://www.thousanddays.org/

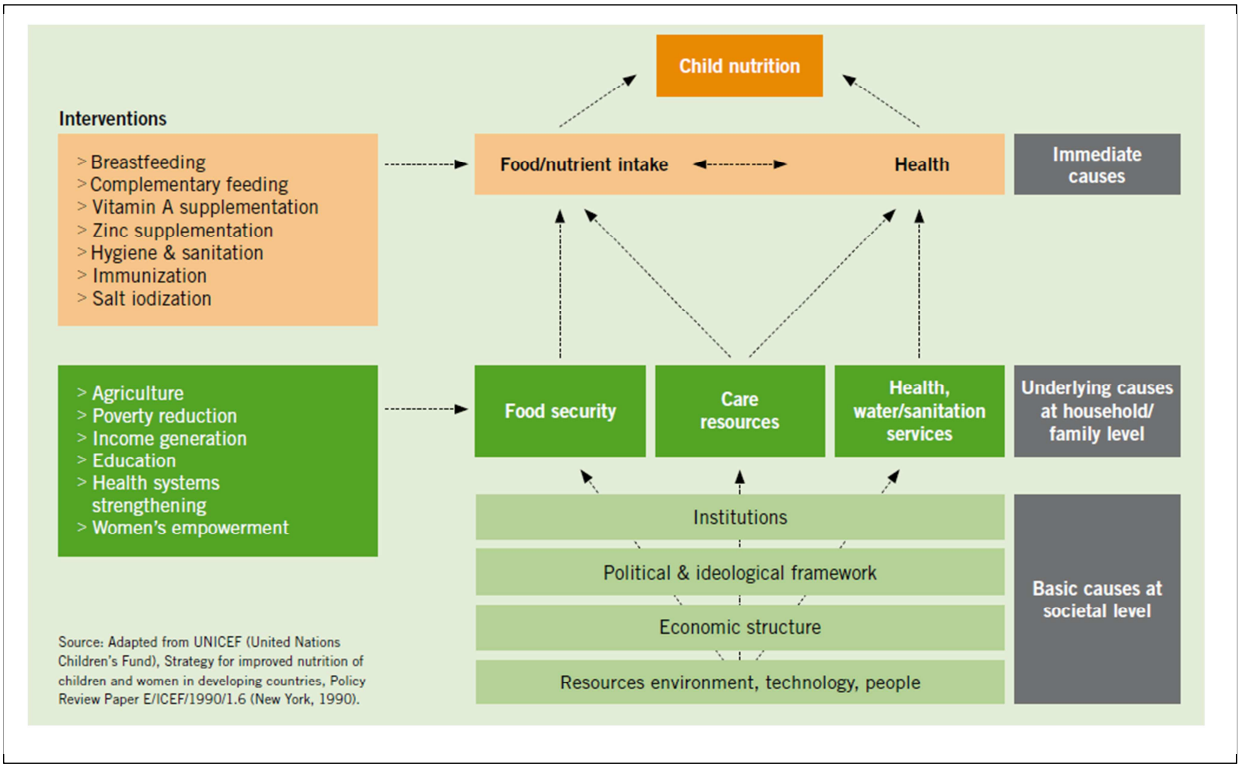
This core set of nutrition specific interventions was recommended in the 2008 Lancet undernutrition series, as being those interventions with sufficient evidence of impacting 90% of the global burden of stunting in 36 countries [23], many which are in Africa. Impacting this "window of opportunity" has a direct impact by reducing death, diseases and irreversible harm to future economic productivity. These actions are not costly and offer high returns over the entire lives of children at risk - in terms of their mental development, earning power and contribution to the economies of their communities. These *nutrition-specific* interventions have been identified among five of the top ten development investments that yield the highest social and economic returns.

While highlighting the evidence-based core interventions, these recommendations are strengthened with a multi-sectoral approach that incorporates nutrition sensitive interventions from other sectors, such as agriculture, education and social protection as shown in **Figure 28** that address underlying causes of undernutrition. The private sector and food industry will also play a pivotal role in food based approaches and value chains. Some suggested nutrition sensitive interventions include: [148] [70]

- Integrated farming systems exploiting the synergies of horticulture, aquaculture and small livestock rearing to reduce waste and expenses on agricultural inputs and increase food production diversity;
- Education and development communication for development and social marketing strategies that strengthen local food systems and promote cultivation and consumption of local micronutrient-rich foods;
- Improved post-harvest management (food storage, transformation, handling and processing) to reduce losses in terms of quantity and nutrients content also contribute to nutrition security;
- Economic development, employment creation and business enterprise for women;
- Improving women's status and decreasing women's workload especially during pregnancy;
- Facility-based nutrition and health services (health and nutrition services, and antenatal care);
- Maternal nutrition, education, knowledge, and care-seeking during pregnancy and lactation;
- Improvements in basic primary health services such as immunizations, family planning and infectious disease control such as malaria;
- Conditional cash transfer programmes and social safety nets;
- Safe water and sanitation, and hygiene education.

While the underlying determinants of malnutrition have been well understood for decades, the design, testing and scaling of more holistic multi-sectoral packages that combine child and maternal care and disease control with food system and livelihood-based approaches have been limited in their development and implementation. With the tools, knowledge and motivation that are currently at our disposal, there is a renewed focus to include interventions that address the root causes of food and nutrition security as part of a wider multi-sector approach.

Figure 28: The Determinants of Child Undernutrition and Potential Interventions [42]



Social protection and safety nets as a long-term intervention

Social safety nets protect people against risk and vulnerability, mitigate the impacts of shocks and support people who suffer from chronic incapacities to secure basic livelihoods. It is important that these interventions focus particularly on food and nutritional security. The social protection aspect of safety nets are approaches that provide or substitute for income, and may include cash and in-kind transfer programs, subsidies, and labor-intensive public works programs. Also included are mechanisms to ensure access to essential public services, such as school scholarships and fee waivers for health care services [149]. Food-based safety nets are designed to ensure livelihoods (for example, through the provision of public works employment paid in food), increase purchasing power (through the provision of food stamps, coupons, or vouchers), and relieve deprivation (through the direct provision of food to households or individuals) [149].

The most common types of food-based safety net modalities are supplementary feeding, food vouchers or stamps, food for work or asset and conditional cash transfers that also involve food [150] (See **Text Box 3**). Food voucher programs provide vouchers that may be used for the purchase of food or specific food and can create less dependency than direct food distribution. Food vouchers include the provision of coupons to purchase a fixed quantity of food (commodity-based vouchers) or food for a fixed monetary value (value-based vouchers). They share a similar market-based approach under which beneficiaries are provided with purchasing power to access food [151]. Food vouchers can be given at the

same time with primary health care services or education as an incentive for participation [149].

Whether food or cash transfers are more effective is an ongoing debate and it is difficult to attribute a nutritional outcome to either food or cash [152]. Research has shown that when given cash, some individuals tend to use cash to diversify and increase the quality of their diets (e.g. buying more meat and eggs and less cereals) and sometimes cash has been shown to trigger higher kilocalories availability at the household level than food aid does [153]. While there is emerging evidence on short-term nutritional effect of cash in Latin America, relatively little is known about longer-term health and nutrition effects, particularly for Africa [152]

TEXT BOX 3
ETHIOPIA'S MERET SAFETY NET PROGRAM

Ethiopia is one of the poorest countries in the world, with natural resource degradation being one of the most serious challenges in development. MERET (Managing Environmental Resources to Enable Transitions to More Sustainable Livelihoods) is a joint program between the Ethiopian government and the WFP aimed at addressing this challenge. It aims to build communities' resilience against shocks, and improve the livelihoods of rural households, particularly those headed by women. Chronically food-insecure communities participate in projects to rehabilitate the natural environment, and create productive assets. This involves participation in income generating activities aimed at improving livelihoods while using local natural resources in a sustainable manner [3]. Examples of program activities include the construction or rehabilitation of roads, reforestation, land restoration and soil conservation, and restoration of rainwater ponds and springs. As a result of the MERET program, 300,000 hectares of land have been restored [7], with one million people benefiting annually, in 600 communities across Ethiopia. MERET has helped to improve food security because the soil and water conservation has facilitated diversification of agricultural production including the cultivation of a wide variety of cash crops – especially fruits and vegetables, some of which were kept for consumption, but most of which were sold – and increased productivity and food availability. All these households continued to produce teff, maize and sweet potatoes as well [11]. Some participants were double and triple cropping as a result of MERET, and some said they had increased use of high-yielding seeds [11]. In 2005, 41% of MERET households claimed their food deficit months had declined by two or more months as a result of the project [16].

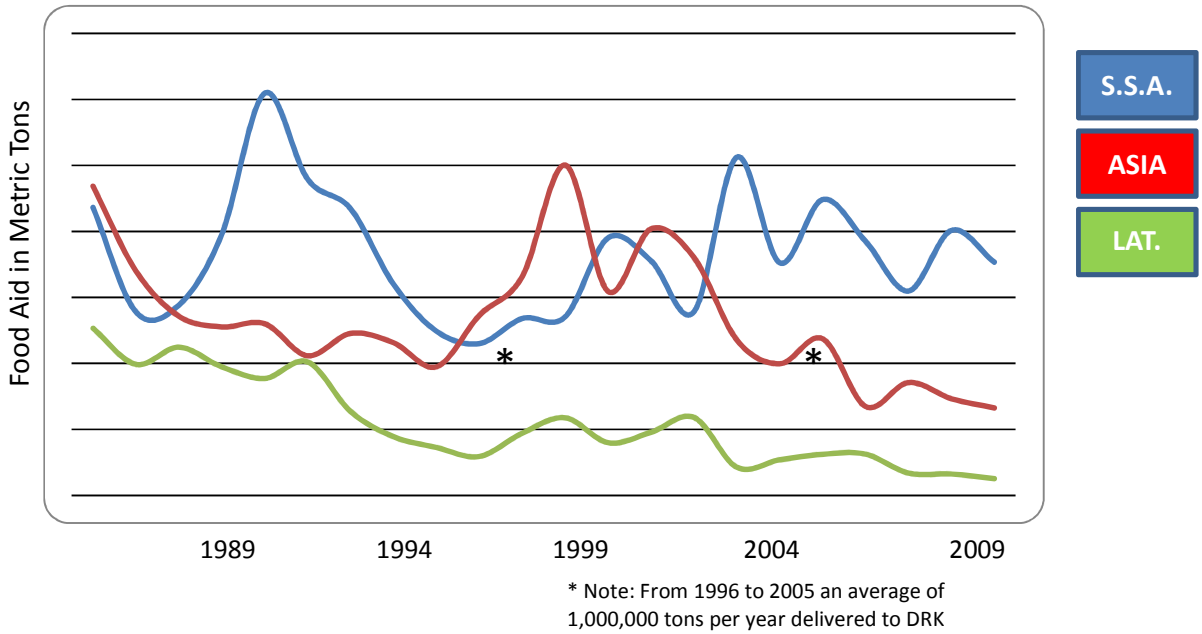
A typical notion of what safety nets looks like is in the form of emergency food aid and distribution however safety nets go beyond just emergency-type situations. Targeted food distribution is a first-response tool in situations where acute hunger is life threatening after a shock. The main issues in the aftermath of shocks are often both availability and access to food. When markets are not functioning and infrastructure has broken down, food may not be available. Re-establishing food and nutrition security, through targeted food distribution programs, is often a priority. There is also a need to provide improved nutritional products that address high acute malnutrition rates in emergency situations. Once the immediate response has enabled vulnerable individuals and communities to survive, it is important to

work with communities to improve livelihoods through transitionary periods – to jumpstart longer-term development processes [154].

Although some consider emergency assistance expensive, the cost is small compared to the cost of hunger. A recent report from the World Bank found that good quality food aid can save billions of dollars that would have to be later spent on saving lives from nutrition-related illnesses [76]. Further to this are the massive costs associated with a lack of education and loss in human capital as a result of hunger and undernutrition. Food aid does not always focus on the key window from pregnancy until when a child reaches two years of age, which is when women and children are most vulnerable [155] [76]. Although difficult to do in times of emergency, food distribution programs could be very effective from a nutritional standpoint if children and pregnant mothers received special priority. Distribution could also be complimented with vouchers for specific nutritious foods [156] [131], and linkages to other health and education services for women and children.

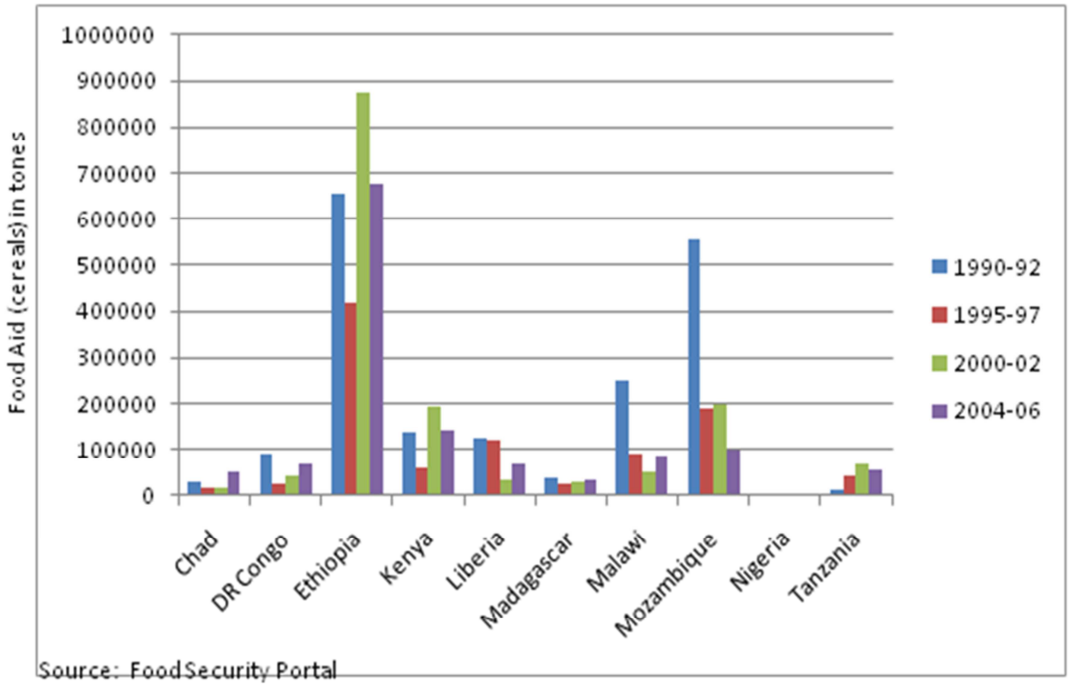
Food aid to Africa has been imperative particularly for countries submerging in conflict or experiencing the consequences of climate change. **Figure 28** charts the food aid received by sub-Saharan Africa in actual tons of food for the last twenty or so years as compared to Asian and Latin American regions. From the figure, food aid has gone in waves – of some years being less than others. In 1992, food aid peaked at 6 million tons going to Africa, whereas 2009 shows that almost half of that amount was distributed. Asia and Latin America's aid has been generally declining since 1989. **Figure 29** shows food cereal aid to 10 selected African countries with a high burden of malnutrition from 1990 to 2006. From the figure, it is clear that Ethiopia was one of the largest recipients of aid due to the periods of significant drought [157].

Figure 29: Food Aid Received by Region: 1988 - 2009 [157]



* Note: From 1996 to 2005 an average of 1,000,000 tons per year delivered to DRK

Figure 30: Food Recipient Trends in Ten African Countries: 1990 to 2006 (IFPRI 2011)



Global, regional and national initiatives that impact Africa's nutrition situation

Progress in solving the food security challenges for Africa is gaining momentum, at all levels of governance. Commitments made in Aquila in 2009 were for more funds for food security and global health in Africa. Action has been now taken following this promise with The Global Agriculture and Food Security Program (GAFSP), a multilateral mechanism to address the underfunding of country and regional agriculture and food security strategic investment plans. To advance this commitment, the United States, Canada, Spain, South Korea and the Bill and Melinda Gates Foundation have contributed funds thus far towards approved national agriculture projects in Ethiopia, Niger, Rwanda and Sierre Leone. The nutrition investments within GAFSP are limited, however there has been more momentum and focus on ensuring nutrition is integrated into the wider food security initiatives. Several global, regional and national programs and policies are demonstrating integration.

The scaling up nutrition movement

The SUN Movement aims to support governments committed to achieving sustained and significant reductions in levels of child under-nutrition through a combination of both specific nutrition interventions and nutrition-sensitive development in related sectors such as agriculture and social protection.

It draws upon the Scale Up Nutrition Framework[3] and the Road Map for Scaling up Nutrition[4] that were developed over the course of 2009 and 2010 by an ad hoc group of developing countries, donor agencies, civil society groups, scientists and agencies working with the private sector. The SUN Movement has the full involvement of FAO, UNICEF, WFP, WHO, the World Bank, the UN Standing Committee on Nutrition (SCN) and the interagency REACH process.

The Road Map for implementing the Framework was completed in advance of the UN General Assembly Summit on the Millennium Development Goals in September 2010. The work was chaired by the Secretary-General's Special Representative for Food and Nutrition who was supported by the UNSNC Secretariat.

Concerns about uneven progress towards the Millennium Development Goals (in particular MDG 1 -to halve poverty and hunger by the year 2015) stimulated calls to action during the Summit. In September, the UN Secretary General together with the heads of WHO, WFP and UNICEF, and senior officials from FAO, the World Bank and the SCN, joined leaders from Governments, civil society, the research community and the private sector in committing to the implementation of the SUN Road Map within a Movement for Scaling Up Nutrition.

SUN is supported by the 1,000 Days advocacy initiative[5] that focuses attention on the 1,000 day window of opportunity between pregnancy and a child's second birthday, when

[3] http://site resources.world bank.org/NUTRITION/Resources/281846131636806329/PolicyBriefNutrition.pdf

[4] http://un-foodsecurity.org/sites/default/files/SUNRoadMap_English.pdf

[5] http://www.thousanddays.org/

adequate nutrition has the greatest impact on saving lives and on cognitive and physical development. The 1,000 Days initiative calls for action to support nations achieve improvements in their people's nutritional status within one thousand days – i.e. between the September 2010 MDG Summit and June 2013.

The SUN Movement will be a success if it helps national authorities and other in-country stakeholders in countries affected by under-nutrition to (a) intensify existing efforts for better nutritional outcomes, (b) maximize their impact (and demonstrate it), (c) have better access to responsive external support, and (d) coordinate that support and ensure it is aligned to national strategies.

As the Governments drive their efforts to scale up nutrition, it will ascertain areas where it feels others may be able to assist. In-country actions are likely to include (a) the convening of a national multi-stakeholder platform that includes our UN system, partners from civil society, the private sector, the research community and donor agencies (b) the identification of a lead development partner prepared to convene and coordinate the donor community (c) a stock taking exercise to identify existing capacities and resource gaps and (d) the completion or updating of national nutrition strategies that enables multiple stakeholders to align their support and assist Governments to realize their goals.

Work of the SUN movement is being supported by six inter-linked "Task Forces" under the stewardship of the SUN "Transition Team". It continued to be chaired by the SRSG and backed by the Chair of the SCN with ongoing support from the Executive Secretary of the SCN and the Secretariat staff. FAO, UNICEF, WFP, WHO, the World Bank and the interagency REACH process are fully involved. The Transition Team is tasked with bringing the SUN Road Map to fruition by focusing on arrangements that enable countries committed to scaling up to be able to access coordinated and responsive support from development partners, civil society and the private sector as and when needed. This SUN Transition Team is due to be replaced by a more permanent stewardship arrangement that will be established following studies of alternative options later this year. At the same time, the reform of the UNSCN is progressing and coming to a conclusion with the recent establishment of the UNSCN Executive Committee composed of Assistant Director Generals and Deputy Executive Directors of FAO, WHO, UNICEF and WFP. At the country level, the UN system is committed to joint working on food and nutrition security. The leadership of the Resident Coordinators will be crucial for bringing the UN system together to act as one.

In recent months the heads of government or senior officials from several other countries have indicated their intention and commitment to achieving sustained and significant reduction in levels of child undernutrition through a combination of specific nutrition and nutrition sensitive interventions, and have requested support. These countries are engaged in building the Scaling Up Nutrition Movement and have been identifying themselves as "Early-Risers". In these countries, a lead development partner in country is being identified (the donor convenor) who will convene and coordinate the donor community to support national nutrition plans going to scale.

The "early-riser" African countries include Ethiopia, Ghana, Malawi, Mozambique, Niger, Senegal, Tanzania, Uganda and Zambia. Three countries, Zambia, Niger and Malawi, have submitted a formal letter of request indicating their intention to go to scale and engage in the SUN movement. The list of Early Risers will not be exclusive and the core principle that countries are leading their own efforts to scale up nutrition remains paramount.

Committee on world food security

The Committee on World Food Security (CFS) serves as a forum in the United Nations System for review and follow-up of policies concerning world food security, including food production and physical and economic access to food. In the 35th Session in 2009, the members of CFS agreed to undergo a reform process to ensure the CFS is "the foremost inclusive international and intergovernmental platform dealing with food security and nutrition and to be a central component in the evolving Global Partnership for Agriculture, Food Security and Nutrition."[6] The CFS will focus on global coordination and strengthening of hunger and food security initiatives, plans and strategies, at the regional, national and local level and ensure decisions are science-based working with all relevant stakeholders. It is with hope that Africa will be greatly impacted by this reform.

Stakeholders include the UN agencies including the International Fund for Agricultural Development (IFAD), the World Food Programme (WFP), FAO and other UN bodies, civil society and non-governmental organizations, particularly organisations representing smallholder family farmers, fisherfolk, herders, landless, urban poor, agricultural and food workers, women, youth, consumers and indigenous people, international agricultural research institutions, the World Bank, the International Monetary Fund, regional development banks, and representatives of private sector associations and philanthropic foundations. The UN High Level Task Force's Comprehensive Framework for Action (CFA) will also be included. The CFA focuses on measures needed to scale-up and improve food and nutrition security including the need to promote investments in agriculture focused on smallholder farmers and rural development [121, 158]. How nutrition will be integrated is still a question within the CFS and the CFA are still unclear however the SUN process may facilitate that integration into wider food security reforms.

REACH

REACH is a UN interagency partnership with governments aimed at scaling up complex multi-sectoral approaches to undernutrition and hunger. By pooling resources of the national government, the UN, civil society and private sector, countries lagging behind on attaining MDG1, can accelerate their efforts. REACH is a joint effort to support countries in accelerating progress on MDG1, specifically the underweight target. REACH supports government-led efforts to deliver - at scale and in an integrated manner - interventions across multiple sectors that are proven to have impact within two to five years. The five interventions areas are aimed at improving hygiene and parasite control, increasing food availability and accessibility, increasing micronutrient intake, improving infant and young child feeding practices and treating severe acute malnutrition. The REACH initiative goes

[6] http://www.fao.org/cfs/en/

beyond the Lancet series to address longer-term determinants including food-production approaches as well as cash transfers.

The REACH partnership has piloted this program in one African country, Mauritania [159]. Mauritania has made great progress on the MDG1 indicator of children under the age of five who are underweight, effectively decreasing levels from 48% to 31% between 1990 to 2008 [31]. In Mauritania, in partnership with REACH, the government developed a nutrition action plan, mapped out all the partners working within the country and did an assessment on what interventions are being implemented, where, and at what scale. Early results show that distribution of vitamin A, iodized salt, mebendazole for worm treatment have been streamlined with increased coverage. Exclusive breastfeeding rates have also increased in one year, and systems have been put into place for supplementary and therapeutic feeding to screen and monitor children suffering from acute malnutrition [15].

The US Government's Feed the Future

Feed the Future (FTF), the U.S. government's global hunger and food security initiative, which pledged at least $3.5 billion for agricultural development and food security over three years, helped to leverage and align more than $18.5 billion from other donors in support of a common approach to achieve sustainable food security[7]. FTF will work in partnership with countries and other stakeholders including the private sector, multilateral institutions and NGOs, to address the needs of small scale farmers and agri-businesses, with women as a the central focus to drive economic growth. FTF will increase investments in nutrition and agriculture development while maintaining humanitarian food assistance. The major goals are to reduce poverty and undernutrition. These goals will be achieved by accelerating inclusive agriculture sector growth through improved agricultural productivity, expanded markets and trade and increased economic resilience in vulnerable rural communities; and improving nutritional status by increasing access to diverse and quality foods and by strengthening the prevention, identification and treatment of undernutrition. The African countries of focus are Ethiopia, Ghana, Kenya, Liberia, Malawi, Mali, Mozambique, Nigeria, Rwanda, Senegal, Tanzania, Uganda and Zambia.

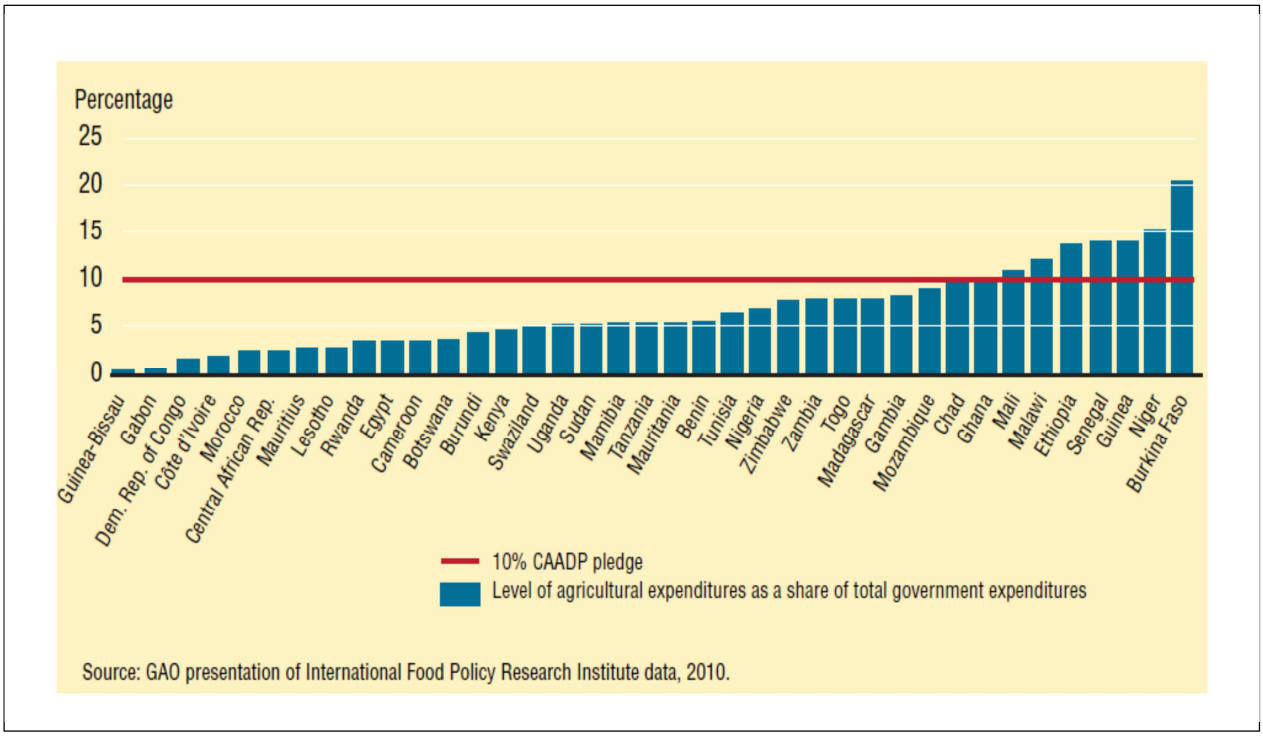
Comprehensive Arica Agriculture Development Programme (CAADP) and NEPAD

In 2003, the African Union and its members endorsed the Comprehensive Africa Agriculture Development Plan (CAADP) within the larger New Partnership for Africa's Development (NEPAD) with the goal to eliminate hunger and reduce poverty through agricultural development. The plan is based on four areas of development: land and water management, market access, food supply and hunger, and agricultural research. Through CAADP, African countries committed to increase their investment in agriculture by dedicating 10% of national budgets to agriculture and to attain an average annual growth rate of 6%. So far, twenty countries have adopted the regional strategy at national level however many have a long way to go in reaching the 10% CAADP pledge (see **Figure 31**) [126].

[7] http://www.feedthefuture.gov/commitment.html

Although CAADP is focused much more on agriculture investments, in 2011, the Global Alliance for Improved Nutrition (GAIN) and NEPAD signed a Memorandum of Understanding to develop a five year joint program to support national investment programs which fully integrate nutrition security into the CAADP and to harmonize CAADP and nutrition interventions in Africa. With this agreement, GAIN and NEPAD will assess existing policies, practices and capacities in agriculture, nutrition and food security. GAIN and NEPAD will take the lead in engaging private sector, donors and national decision makers and coordinate action in expanding access to more nutritious food.

Figure 31: National Expenditures on Agriculture of African Countries and CAADP Goal [126]



Regional Initiatives and Focus

ECOWAS

The Economic Community of West African States (ECOWAS) is a regional Institution of fifteen countries, founded in 1975 with a mission to promote development and economic growth. Within ECOWAS is the West African Health Organization (WAHO) which is a specialized public health agency of ECOWAS. WAHO coordinates the ECOWAS Nutrition Forum, established in 1996 as a mechanism to organize and bring together nutrition actors from the 15 member states. A major objective of the forum is the establishment and maintenance of cross-sectoral dialogues and actions that would result in impact oriented food and nutrition programmes. WAHO is thus charged with facilitating effective food and nutrition policies and programmes that ensure food and nutrition security in the region. In

this capacity, and emphasizing the role of foods sourced from agrobiodiversity within local food systems, WAHO has assumed an active leadership role in cross-sectoral partnership activities that promote the mobilization and use of agrobiodiversity within the local food systems in national and regional programmes against hunger, food insecurity, micronutrient deficiencies and diet related chronic diseases. The forum brings together experts and stakeholders to address major nutrition challenges within the region on nutrition policies, programming and linking agriculture and health/nutrition programs and promoting local foods production, for diet diversity.

The African community and the Africa Union also endorsed the African Regional Nutrition Strategy 2005–15 that integrates undernutrition as one of the most important health and social challenges in Africa. The Regional Nutrition Strategy recommends the integration of nutrition as a specific issue in national policy-making. (Montero et al., 2010; WHO African Regional Nutrition Strategy 2005-2010).

Consultative Group for International Agricultural Research (CGIAR) research program on agriculture, nutrition, and health

The CGIAR commits to reduce poverty and hunger, improve human health and nutrition, and enhance ecosystem resilience through high-quality international agricultural research, partnership, and leadership in the 2010 Strategic Framework. The CGIAR Research Program (CRP4), *Agriculture for Improved Nutrition and Health,* directly and strategically supports this commitment.

Agriculture will need to develop and expand to meet the food needs of a growing population from a finite resource base. How agriculture develops to do this can have consequences on the health and nutrition of people. This program is designed to support the overall CGIAR research agenda by improving the understanding and options for how agriculture can better accentuate the positive benefits and mitigate the risks of agricultural development on human health and nutrition. These lessons are meant to serve the entire CGIAR agenda, within agroecological production systems and along food value chains.

Emphasis will be placed on two populations of people. The first group is those people who are left behind by socioeconomic development, suffer from high rates of malnutrition and agriculture associated diseases, and rely on aid and development support. The second group is those poor people in dynamically intensifying and changing systems in which research can help shape agricultural development more positively and safely.

One of the major areas of focus is in sub-Saharan Africa, and it is hoped that the research coming from this research program will provide new information, tools and evidence of the importance of linking agriculture to nutrition and health outcomes for Africa. Funding for this proposal is pending.

Malawi: A two pronged approach of agriculture and nutrition, and political will

The smallholder farmer sub-sector of Malawi comprises about 2.4 million households with an average farm size of 1.2 hectares (ha). Maize, the staple food crop, is grown by 97% of farming households on about 1.6 million ha of smallholder farms and contributes 60% to total calorie consumption [160]. Over decades of intensive cultivation in the absence of

fertilizer use or correct crop rotation techniques, soils in smallholder fields have been depleted of nutrients, particularly nitrogen. National yields of smallholder maize have averaged 1.2 MT/ ha during the last 20 years [161]. More than half of the farming households operate below subsistence levels. Only 20% of maize producers sell their product and most households purchase maize at much higher prices when stocks are exhausted.

In the 2004/5 rainy season, many parts of the country went without rain for up to one month during January and February 2005. This dry spell had a devastating effect on maize production: the national average yield dropped to 0.76 MT/ha, one of the lowest on record. Total maize production for the 2004/5 season was just 1.23 million MT -- a decline of 24% from the previous year, and just 57% of the estimated national maize food requirement. The UN issued a "flash appeal" for food aid and agricultural inputs. Donors responded with food aid but were unwilling to support an input subsidy.

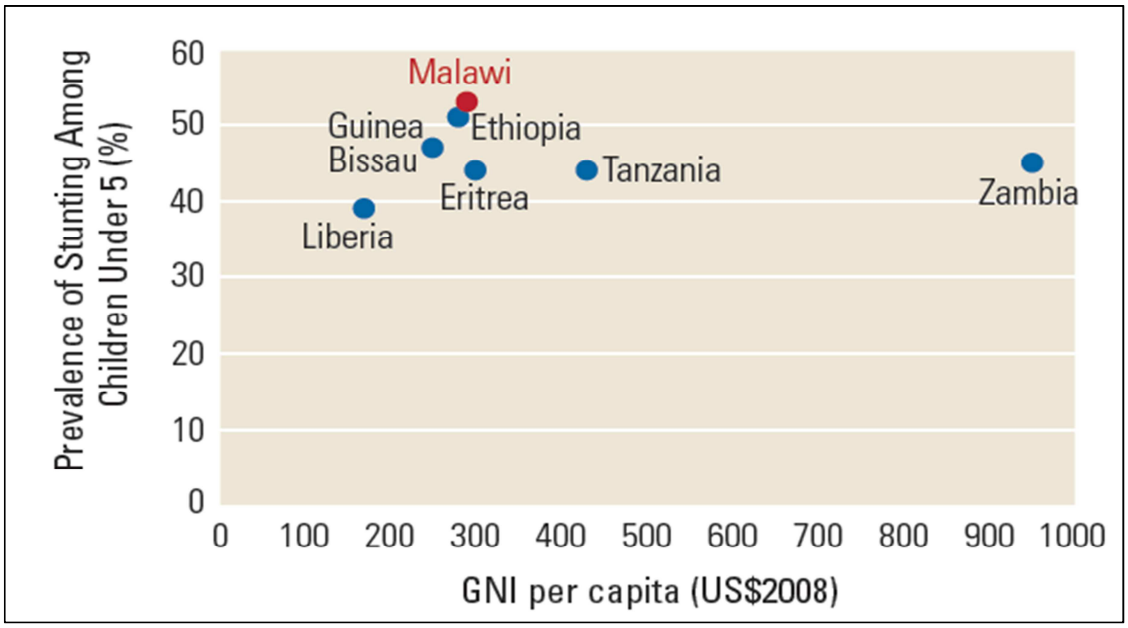
The Government of Malawi responded in mid-2005 with a national scheme to subsidize improved seed and fertilizer [162]. The scheme involved the distribution of fertilizer vouchers (not more than two per household) and seed vouchers that enabled most smallholder farmers to purchase fertilizer and seed at about one quarter of the market cost. Drawing on $58 million from its national budget in 2005, $65 million in 2006, and an estimated $80 million in 2007, the program reached most of Malawi's smallholder maize farmers. Resulting harvests in 2006, 2007, 2008 and 2009 have dramatically improved the level of national and household food security [1] [163] (**Table One**). The surplus of over a million MT in 2007 enabled the country to export 300,000 MT maize to Zimbabwe and contribute to regional food security through World Food Program procurements [164]. The Government recently announced resumption of exports following the record 2009 harvest. Malawi's experience demonstrates the feasibility and value of investing in food crops grown by smallholders as a first step towards sustained economic growth and improved human development. In a country where agriculture employs 78% of the national labor force and provides food security and livelihoods for over 10 million people, agricultural productivity growth is having a direct positive effect on the broader achievement of the MDGs.

Table One: Food Production in Malawi from 2003-2009 [1]

	2003	2004	2005	2006	2007	2008	2009
Production (mil MT)	1.98	1.61	1.23	2.58	3.44	2.78	3.66
5-year av. 2001-2005 (mil MT)	1.62	1.62	1.62	1.62	1.62	1.62	1.62
% above average	22%	-1%	-24%	59%	112%	72%	126%

Malawi also suffers from a high burden of undernutrition. As shown in **Figure 32,** stunting among children under five, remains staggeringly high as compared to other African countries with the same GNI per capita [2]. One innovation being scaled is the treatment of acute malnutrition through CMAM.

Figure 32: Prevalence of Stunting in Malawi Compared to Neighboring and Income Peer Countries [2]



At the same time as the subsidy program, Malawi began piloting CMAM with UNICEF, Concern and Valid International in select districts. Once piloted in two districts, the monitoring results were encouraging with 87% of children discharged successfully from the program [6] [9]. Since this pilot, the program has been scaled nationally, and is considered a model for national coverage. For the scale up program, the national MOH is in the lead, providing direction, resources and support directly to district health offices. NGOs have contributed additional technical support to the CMAM Support Unit. Currently, 344 CMAM sites and 96 inpatient units have been implementing the program in 24 of 28 districts of Malawi [13]. Malawi is now reaching 74% of children in need of treatment with a 75% recovery rate [15].

Although Malawi and other places African countries such as Niger and Ethiopia have shown that scalability of CMAM can work with the right governance and support, challenges remain. First, horizontal integration of CMAM programs into weak health and procurement systems adds complexity and burden to those working on the ground if not well coordinated. Second, the "C" of CMAM should not be underemphasized - community mobilization, participation and ownership must be included in large scaled-up national programs in order to succeed in local pockets [6, 165]. Third, a challenge remains in that CMAM may be equated solely with the distribution of RUTF instead of "a holistic treatment

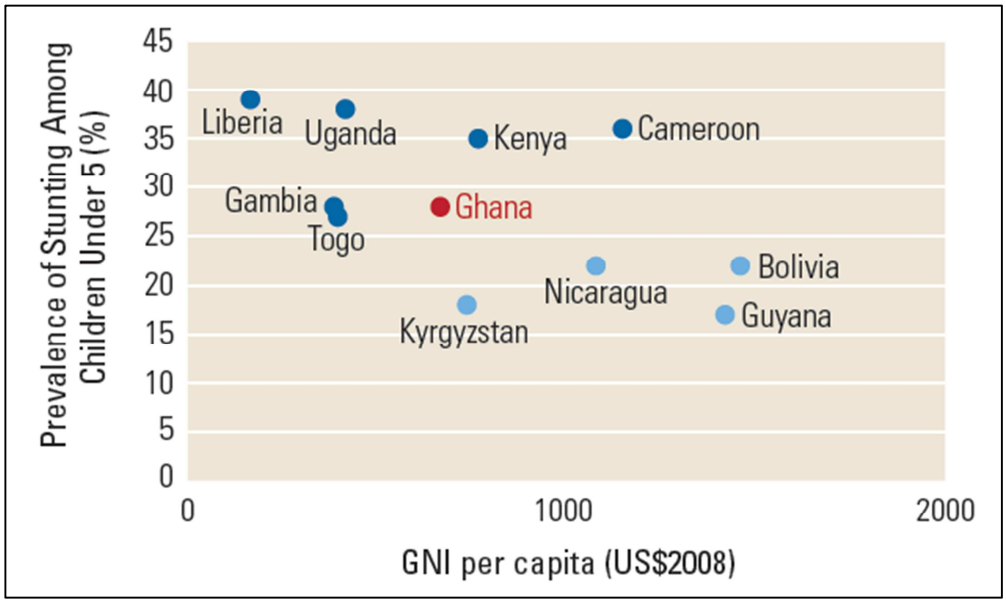
paradigm that requires close supervision by health and nutrition professionals" [166]. However, where the national program has not yet reached, promising outcomes can be made in resource-constrained settings.

The Malawi government and DFID have set up a national Vulnerability Assessment Committee that will survey the food and nutrition security situation through a more robust surveillance system. Tackling different aspects of food security may prove to be effective in Malawi, along with the political will of the government and the assistance of international organizations. DHS 2010 surveys will hopefully be released in 2011 to determine early impacts of a multi-prong approach [37].

Ghana: improving nutrition at the policy level and through economic growth

Ghana is generally considered food secure with agriculture as the main livelihood for most of the population. Ghana's underweight prevalence stands at 18% with an AARR of 3.1% [15]. The proportion of those undernourished has gone from 34 to 9% since 1990, meeting the MDG1 target. Although progress has been made, stunting remains high [167], and Ghana is considered one of the top 36 countries with a high burden of undernutrition (**Figure 33**) [23]. In-country disparities when comparing the north to the south, and urban and rural dichotomies weigh heavily in these national figures. Although still considered a developing country, Ghana is economically stable with a sound political system. The national government is committed to ending hunger and undernutrition, and has elevated the Nutrition Unit to a department level, giving it autonomy and resources for programme planning and implementation.

Figure 33: Prevalence of Stunting in Ghana Compared to Neighboring African Countries and Income Peers [167]



Ghana has been affected by many of the challenges to address nutrition including lack of adequate funding, the nutrition sector being straddled amongst many ministries, the low priority and the necessary capacity to build a robust national policy. A landscape assessment was conducted to assess levels of commitment and capacity to scale up hunger and nutrition interventions and programmes [168]. This assessment showed that the country has over 20 policies and strategies that have been put into place aimed at improving undernutrition including the 2005 Ghana Free of Malnutrition, the Community-based Growth Promotion Programme and the Health Sector Programme of Work 2007-2011 [169]. Despite these programmes, there remains no national food and nutrition policy. Furthermore, the data information and reporting systems had not previously been centrally coordinated, making assessments on progress towards nutrition unclear [168]. The programmes cover a breadth of nutrition interventions in multiple sectors, but it is acknowledged that coordination and collaboration between government agencies may not work as effectively as they should. The Ministry of Food and Agriculture controls the food security and production budget; whereas Ministry of Health controls health aspects of nutrition, leading to competing sources of funding and no principle department with lead responsibility.

The first nationwide comprehensive food security assessment was released in 2009 [170]. The results showed that persistent food insecurity was concentrated in the poorest regions of the country - areas that were the most prone to floods and droughts that that had been disproportionately affected by 2009's soaring food prices [170]. The two main policies designed to address food insecurity challenges include the National Social Protection Strategy whose objective was to provide policy direction regarding the protection of persons living in extreme poverty. The Food and Agriculture Sector Development Policy plays a complementary role in supporting smallholder farmers with extension services to rural areas.

With these challenges of funding, coordination, and the absence of a clearly articulated policy, how has Ghana progressed towards the MDG1? Some of the credit for Ghana's success has been linked strong economic growth led primarily by the agriculture sector particularly the improvements in maize, yam, rice and cassava varieties alongside improved agriculture services. There has been a 25% increase in cropped area, and a 36% and 50% increase in yields of maize and cassava respectively. Market liberalisation has had a positive impact for the cocoa sector [171].

Accompanying these economic changes, there has been a significant investment from NGOs, with resources, capacity and technical tools to assist Ghana, with much of the funding (two-thirds to three-fourths) to support nutrition security [172]. Programs such as PROFILES, a process for nutrition policy and advocacy designed to demonstrate the contribution that improved nutrition can make to human and economic development has been working in Ghana to assist in improving the effectiveness of the action plan [70]. These initiatives are an important first step, and should serve a solid foundation on which to build a comprehensive and durable response to hunger and undernutrition.

Conclusion

Persistent malnutrition remains an inexcusable unfinished agenda and successfully closing the few remaining gaps is a pre-condition for wider progress towards human development for the continent. The strongest lesson emerging from community-based, national, and international efforts is that making rapid gains in improving nutrition is possible. Through energetic and engaged national leadership in Africa and with the support of robust international partnerships, rapid progress in reducing levels of hunger and undernutrition is attainable. Accelerating nutrition security is less about the development of novel innovations and new technologies and more about putting what is already known into practice. Success will hinge on linking clear policies with effective delivery systems for an evidence-based and contextually relevant package of interventions that can rapidly be taken to scale. There is still room for research in developing the technical and scientific evidence underpinning interventions and understanding what works on the ground. The challenge is integrating the delivery of these interventions within locally owned, locally appropriate systems that facilitate high levels of cost-effective coverage on a sustained basis. This will take substantive and prioritized financial commitment at the national and international levels.

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