

Agriculture, nutrition and health essentials for non-specialist development professionals

A follow-up paper to the IFPRI 2020 conference *Leveraging Agriculture for Improving Nutrition and Health*, Delhi 2011

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Introduction and rationale

Most delegates at the 2020 Conference *Leveraging Agriculture for Improved Nutrition and Health* were expert or programmatically active in agriculture, nutrition, or health, but very few had specialist expertise that crossed sectoral boundaries. A major finding of the conference was that a key barrier to integration between agriculture, nutrition and health professionals was a lack of understanding of the sectors in which participants were not active, and lack of a common ‘language’ with which to debate. This brief report aims to outline basic concepts and definitions, tools and indicators, and common interventions used by each development sector, in order to provide a baseline level of knowledge and understanding on which to build dialogue and collaboration.

Agriculture essentials

Agriculture is the primary livelihood of the majority of rural poor in developing countries (though the work is often self-employed and unpaid), with rural households often both producers and consumers of agricultural goods. Agriculture in development is concerned with strengthening the ability of farmers and farming communities to produce and market agricultural goods in order to sustainably generate both food and income. Improving productivity is key to this; barriers to agricultural development include lack of access to finance and credit, and to farming inputs such as new technologies, irrigation, chemicals, and/or labor; vulnerability to pests, drought, illness and other shocks; and poor infrastructure and access to markets. Agriculture produces food to eat but also products to sell for income, and it has been postulated that the agriculture sector should lead development in largely agricultural economies. The role of women in agriculture has received particular attention, as women tend to be major actors in household- and community-level subsistence farming alongside other household and childcare roles.

Concepts and definitions

The broadest definition of agriculture encompasses the **production of crops, horticulture, agroforestry, hunting, aquaculture, and animal husbandry**. Agriculture is a part of rural **livelihoods**, or the sum of the productive activities undertaken by an individual, household or community. A major aim of agriculture is to provide **food security**, whereby people have adequate food for healthy and active lives; food security is achieved only when sufficient nutritious food is available, and households and individuals have consistent financial, physical and social access to it. Various strategies are undertaken to achieve food and livelihood security: Smallholder farmers sometimes rely on **subsistence farming**, trying to produce the food the household needs; more often, their production is **semi-subsistence**, including sale of excess produce; others have taken up **commercial farming**, often employing farm labor, with excess produce sold for income on various local, national or international markets. **Products** from agriculture include staple crops; high nutritional and monetary value foods such as animal products and vegetables; cash crops such as cotton, sugar and oil palm; and by-products such as biomass, hide and wool. Finally, farmers are the guardians of the **environment** in which they farm, and are often the first to be affected by events such as **climate change**.

Common tools and indicators

Agricultural indicators cover agriculture and rural sector variables; agricultural policy variables; agricultural inputs and the environment; agricultural output and trade; and livelihoods indicators. Agricultural information is captured through data collected by the UN Food and Agriculture Organization (FAO), mainly providing information on production and trade (leading to the measurement of world food supply in yields and calories); and in surveys, including the World Bank's Living Standards Measurement Surveys (LSMS), and those conducted by governments or other organizations.

Rural sector variables include **agricultural employment** (the number or proportion of workers in agriculture), and the **share of women in the agricultural labor force**. **Agriculture value added** is the net output of the sector after adding up all outputs and subtracting intermediate inputs, and can be calculated as a total, as a % of GDP, or per agricultural worker. Agricultural policy variables include **government spending on agriculture; public R&D spending in agriculture** including spending by government, nonprofits, and universities; **Official Development Assistance (ODA) in agriculture** made to countries and territories on the DAC list of aid recipients; and **food aid in cereals** for emergencies, projects and programs. Variables describing agricultural inputs and the environment include areas under **arable and permanent cropland** (land under temporary crops, temporary meadows for mowing or for pasture, land under market or kitchen gardens, land temporarily fallow, and land cultivated with crops that occupy the land for long periods and need not be replanted after each harvest, such as cocoa, coffee, and rubber); the **land Gini index** (a measure of the extent that land distribution in rural areas, among individuals or households, deviates from a perfectly equal distribution); **irrigated area**; measures of **fertilizer consumption** and

pesticide use; rural population access to an all-season road, and to electricity; measures of water availability and use such as **renewable internal freshwater resources per capita** and **annual freshwater withdrawals;** and **average annual deforestation.** Variables describing agricultural output and trade include **average yields** achieved in different crops; **cereal production per capita** (crops harvested for dry grain only- cereal crops harvested for hay or harvested green for food, feed, or silage, and those used for grazing are excluded); **meat, fruit and vegetable production** by weight; **food production per capita,** covering food crops that are considered edible and that contain nutrients (to construct the index, production quantities of each commodity are weighted by international prices); **net cereal imports** presented in U.S. dollars, equal to cereal imports less exports; and **agricultural imports and exports,** presented in U.S. dollars.

Other economic variables commonly collected at national or community level are **food prices** and **consumption and expenditure levels and elasticities** (the responsiveness of household purchasing of goods to their cost). Useful local-level indices include measures of food security and coping strategies such as **Household Dietary Diversity** (associated with household socio-economic status), the **Household Hunger Scale (HHS)** and the **Household Food Insecurity Access Scale (HFIAS);** and livelihoods indicators such as local **wages, land and livestock holdings,** local risks and **vulnerability,** key **assets,** and key local livelihood **strategies.** The **Household Economy Approach (HEA)** is a framework for analyzing how households obtain food, non-food goods and services, and how they might respond to external shocks such as drought.

Common interventions, policies and programs

Interventions for agricultural development fall broadly into four categories: **Policy** interventions to improve the 'enabling environment' for agriculture; interventions to improve **assets and capital** (human, social, financial, physical, and natural capital), particularly women's control of assets; interventions to improve **productivity and sustainability;** and interventions to **diversify income** on and off the farm. Interventions to improve assets and capital include **Farmer Field Schools,** group-based learning to disseminate knowledge and understanding of sustainable crop management processes; **microcredit,** or the provision of small loans, often at favorable rates, to encourage the very poor and marginalized to participate in agricultural entrepreneurship; **animal schemes,** whereby breeding animals are provided to members of a community on the understanding that they will in turn donate a proportion of new animals born to others in the scheme; and **risk insurance,** as a form of social protection against natural disasters and drought. Interventions to improve productivity and sustainability include provision or facilitation of **physical inputs** such as fertilizers and seeds; dissemination of **improved technologies** such as irrigation, improved crop varieties, and mechanization; training on other **agronomic practices** such as intercropping, crop rotation, soil erosion control, and integrated pest management; and the facilitation of **producer organizations and co-ops** for better leverage of conditions and prices. Policy interventions include manipulation of **price policy, subsidies and regulation** in order to encourage trade and improve market access for the poorest farmers. Interventions designed to diversify income include facilitating **value-addition,** where farmers themselves undertake some of the processing, packaging and marketing of their produce in order to increase its sale value and enter the market further up the value chain; the encouragement of diversification into sectors providing **non-farm income,** such as tourism; and **social safety nets** for those periods where farming is not profitable for one reason or another.

Nutrition essentials

Much of nutrition in development is concerned with the prevention and treatment of the various forms of malnutrition, a broad concept taking various forms which are measured and addressed in different ways (see below). The underlying causes of undernutrition (insufficient nutritious food; inadequate health services and unhealthy environments; and inappropriate child-care practices: Food, Health and Care) are shown in the 1990 **UNICEF Framework of Malnutrition** and subsequent revisions (see appendix A). Key priorities in nutrition are exclusive breastfeeding of infants to 6 months, and the inclusion of foods rich in nutrients throughout the life cycle, particularly for women of reproductive age and for young children from 6 months of age; the period from conception to two years old (the first 1000 days) are a particular focus, as nutrition deficits in early childhood affect later health, development and productivity.

Concepts and definitions

Probably the most recognized form of malnutrition is **hunger** or **undernourishment**, defined as not having enough energy (calories) available from food each day for an active life; hunger affects about one billion people in the world today, although outright **famine** (acute and general shortage of food in an area) is becoming rare. Malnutrition in individuals can be defined as chronic (a long-term lack of nutritious food) or acute (a more sudden onset). Chronic, long-term malnutrition leads to **stunting**, or short stature; stunting tends to start early in life, is largely irreversible after 2 years of age, and has long-ranging effects on health and productivity in later life. Acute malnutrition leads to **wasting**, or thinness; wasted individuals have a sharply increased risk of infection and death, and wasting should be treated through clinical management. At the other end of the scale, **overnutrition** and obesity are also types of malnutrition, increasing various health risks such as diabetes and heart disease. Existing alongside any of these forms of malnutrition is **micronutrient malnutrition**, or a lack of the vitamins and minerals necessary for health; the most common micronutrient deficiencies in development are iron deficiency (anemia), vitamin A deficiency, zinc deficiency, and iodine deficiency, which have a range of health impacts. Usually if one nutrient is lacking it is likely that others will also be deficient. Both overnutrition and undernutrition usually have to do with **poor diet quality** (rather than quantity of food or calories).

Common tools and indicators

Nutritionists collect nutrition data through **surveys** of households and individuals within communities, and **clinical data** of individuals. The most commonly used indicators of nutrition status are collected for children under 5; this is a key group not only because malnutrition is particularly harmful long-term in early life, but also because children tend to be a good indicator of the nutrition status of the rest of the population. National-, regional- and local-level nutrition data is collected in the Demographic and Health Surveys (DHS) and Multiple Indicator Cluster Surveys (MICS) undertaken in many countries; through consumption/ expenditure surveys that capture diet and food security data; and through dedicated nutrition surveys carried out by various organizations. Below is a brief presentation of the *ABCD* of nutrition indicators: A is for **anthropometry** (body size measurement), the most common tool for collecting information on nutrition outcomes. In children, weight, height and age data are collected, combined, and statistically assessed (using z-scores, or the number of standard deviations from the mean) against international standards produced by the World Health Organization: Low height for a child's age (**height for age z-score <-2**) denotes stunting; low weight for a child's height (**weight for height z-score <-2**) denotes wasting; and low weight for a child's age (**weight for age z-score <-2**) denotes underweight, a composite measure of the two. Standards also exist to categorize prevalence of these outcomes in a population by public health significance. Two other common anthropometric indicators may be used with either children or adults. **Body Mass Index (BMI)** is calculated by dividing weight (kg) by height squared (m^2), and the result compared to international standards to categorize individuals on a scale from underweight to obese. **Mid-Upper-Arm Circumference (MUAC)** is assessed through a measurement of arm circumference to indicate levels of fat and muscle, and is used to diagnose severe acute malnutrition; a MUAC measurement below international standards denotes wasting, and a higher risk of death.

B is for **biochemical** indicators, meaning in practical terms those nutrients or nutritionally-relevant markers found in the blood or urine that can tell us about micronutrient deficiency. Commonly-measured biochemical indicators are **blood hemoglobin** levels for anemia (commonly collected in the field using a rapid Hemoglobinometer); **serum vitamin A** levels for vitamin A deficiency; and **urinary iodine** levels for iodine deficiency.

C is for **clinical** indicators, including **night blindness** or **Bitot's spots** on the eyes for vitamin A deficiency; **pallor** for anemia; **goitre** for iodine deficiency; and **edema** for severe acute malnutrition, all assessed by clinicians looking at or touching the affected individual.

D is for **dietary** indicators of the foods consumed by households or individuals. A defined and harmonized set of indicators relating to **Infant and Young Child Feeding (IYCF)** has been developed by the WHO, and includes for example proportions of children at certain ages that are exclusively breast-fed, fed appropriate foods, and fed with appropriate frequency. Another common indicator is **dietary diversity** at individual level; this describes the number of food groups consumed, with the number and type of food groups providing an indication of individual diet quality. Other dietary data is collected using a range of tools with varying precision, from **weighed intake diaries** to **food frequency questionnaires**. See Appendix B for further detail on nutrition indicators.

Common interventions, policies and programs

There is a clear distinction in nutrition programming between curative or clinical interventions, seeking to treat existing malnutrition, and preventive or public health approaches; within this, there are a core set of **Essential Nutrition Actions** around child feeding, ensuring micronutrient intake, and care of sick and malnourished children.

Curative nutrition involves the identification of wasted children using the indicators above, their assessment as severely or moderately wasted, and either in-patient clinical management or community-based management of the condition; either may involve the use of **Ready-to-Use Foods (RUF)**, processed 'medicinal foods' with appropriate nutrient content for returning children to health.

Preventive nutrition programming deals with the prevention of malnutrition in nutritionally-vulnerable populations, usually by addressing elements of the Food-Health-Care nexus. Programs providing food and nutrients span **homestead food production** interventions, where households are supported to grow nutritious plant foods or keep animals for food, milk and eggs; **supplementation or fortification programs**, where either single or multiple micronutrients are provided directly through a variety of products; **direct provision of food** or **food vouchers**, or **conditional cash transfers** for the purchase of food; and **school feeding programs**, where children receive a nutritious breakfast or midday meal to boost both nutritional status and school attendance and learning. Programs addressing health include regular **growth monitoring and promotion** of children, to catch early those with growth faltering; and **hygiene promotion** for the prevention of diarrhea, a major cause of malnutrition in children. Programs addressing care practices often have a **social and behavior change communication (SBCC)** component, whereby methods from mothers' groups to social marketing are employed to bring about improvements in knowledge on child feeding and care. All of these aspects may also be affected by underlying issues such as **resources** available for nutrition, and the **policy** environment, with policies as diverse as land rights, women's employment legislation, agricultural subsidies, and social security provision directly affecting nutrition.

Health essentials

Health is a key element of development, where a healthy population is a more productive population and a driver of growth. Conversely, health shocks are drivers of poverty in households that are not able to absorb them, and a cycle of poverty and ill-health is common. There are many factors underlying the attainment of health, from infrastructure (for instance the availability of clinics, or of the roads to reach them) to gender equity (a woman's ability to access appropriate healthcare for herself and her children). Foreign aid for health is improving as donors align for more strategic partnerships, but aid is still often targeted to sub-national or regional programs, with little channeled through national health plans for better coordination and coherence where health systems are weak. Health in development is concerned with the narrowing of gaps in access to health; women and children are key target groups for health interventions, but an overarching theme is the strengthening of national health systems for all.

Concepts and definitions

Health is defined as general mental and physical wellbeing, rather than a simple absence of disease, and therefore health is affected by many factors, including gender equity, education, and economics, among others. Health as it relates to development can be broadly split into **public health**, generally concerned with the prevention of ill health, and **clinical health**, generally concerned with treatment. **Occupational health** is concerned with protecting the health and welfare of people engaged in work or employment, including agriculture. Recognizing that human health, animal health, and ecosystem health are inextricably linked (not least through **zoonotic diseases**), the **OneHealth** initiative seeks to promote health through the integration of human medicine, veterinary medicine and environmental science. **Food and water safety** is another key area of health, with food- and water-borne disease accounting for a large proportion of morbidity in developing countries, linking back to water use in agriculture.

Common tools and indicators

The two most common sources of health information are **surveys**, which may be specific to program needs or may be large national surveys such as the Demographic and Health Surveys (DHS) or Multiple Indicator Cluster Surveys (MICS), and **Health Information Systems**, put in place to capture clinical data. Commonly-used indicators of the health status of populations are the under-5 or maternal **mortality rates**, measuring deaths in these groups; **morbidity rates** in the same groups, measuring prevalence or incidence of different diseases; and **treatment coverage**, for instance access to Anti-Retroviral Therapy (ART) for HIV, or Directly Observed Treatment (DOTs) for tuberculosis. The concepts of Disability or Quality Adjusted Life Years (DALYs/QALYs) are both measures of disease burden: **DALYs** describe the number of healthy years *lost* to disease, disability or early death compared to the ideal or average (combining mortality and morbidity into one measure), while **QALYs** describe the number of healthy life years *gained* through an intervention. In health economics, it is possible to put a monetary value on this healthy life lost or gained, and DALYs/QALYs can therefore be used to assess the cost-effectiveness of an intervention.

Common interventions, policies and programs

Interventions to improve health may focus on infrastructure and health systems strengthening (or realignment to include pro-poor health systems); programs to address specific health issues; or non-health interventions (such as education or social protection programs) which may also have an impact on health. The **strengthening of health systems** could include the hiring and retaining of community health workers; improving management of hospitals; facilitating efficient drug procurement; or improving ICT for health information systems. It may also include **capacity building**, for instance health worker training programs or management training. Programs specific to different health issues include **vaccination** against common childhood diseases; **reproductive health** services, including HIV awareness, family planning, and safe childbirth interventions; **malaria** reduction initiatives, including access to treatment and prevention of bites with bed-nets; **hygiene promotion**, to combat diarrhea; and provision of **testing and treatment** programs

for infectious disease such as HIV and TB. The introduction of a particular intervention or policy will often be directed by evidence of its effectiveness and cost-effectiveness. The WHO and UNICEF have developed the **Integrated Management of Childhood Illness (IMCI)** approach, including both preventive and curative elements at community and health facility level, that focuses on holistic health and wellbeing in children and can improve health care and health systems in developing countries. **Non-health interventions** include for instance the provision of improved cooking stoves, to reduce smoke-induced respiratory illness, a major cause of child mortality, and water and sanitation programs for reduced water-borne infections.

Further resources

Agriculture

The [2008 World Development Report](#) focused on the state of agriculture in development, and is a good starting place for those interested in further reading on agriculture in development.

The FAO has two flagship reports, produced annually with a focus on a key agricultural development topic each year: [The State of Food Insecurity in the World \(SOFI\)](#) and [The State of Food and Agriculture \(SOFA\)](#).

For more information on the [HEA](#), see Save the Children. For the [Household Hunger Scale](#), and its predecessor the [HFIAS](#), and also the [Household Dietary Diversity Score](#), see FANTA publications.

Nutrition

In 2008, [The Lancet](#) produced a series on maternal and child undernutrition, drawing together evidence on key problems and proven solutions in development nutrition. This is a good starting point for those interested in further reading on nutrition in development.

For [IYCF indicators](#) (including validation of dietary diversity scores in children) or [Essential Nutrition Actions](#), see the WHO and USAID publications.

Health

The World Health Organization (WHO) has a large body of work on health and development, available on the [WHO website](#). Their 2005 publication on the [Millennium Development Goals and Health](#) is a good starting point for those interested in further reading on health and development.

For information on [OneHealth](#), and links between agriculture and health, see their website.

For more on the [IMCI](#), see the WHO website.

Linking agriculture, nutrition and health

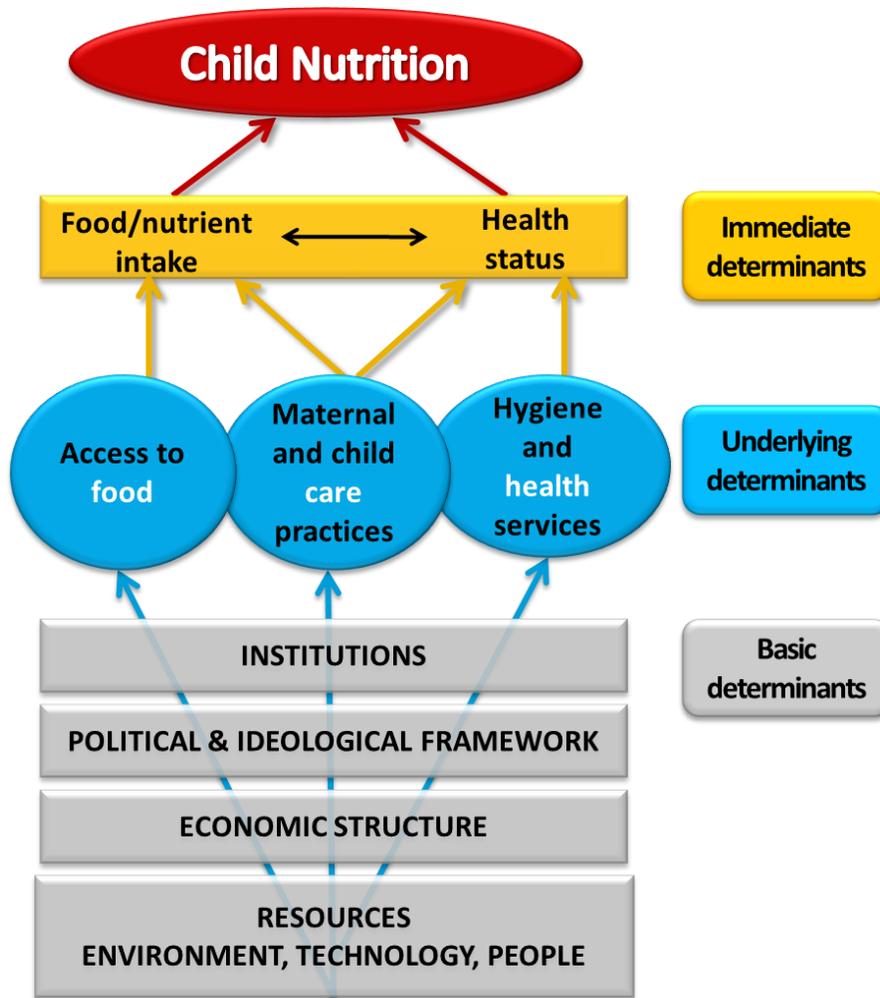
There are some useful resources on the internet for people interested in further information on agriculture, nutrition and health, including an open-access introductory [course on health and nutrition indicators and methods](#) from the London School of Hygiene and Tropical Medicine; the World Health Organization [nutrition pages](#); and the [OneHealth](#) movement linking human and animal health.

The International Food Policy Research Institute has several resources available, including the [post-2011 conference website](#), and the website of the new [Agriculture for Nutrition and Health \(A4NH\) website](#).

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Many thanks to Anna Herforth for substantive comments and recommendations on the final draft.

Appendix A: The UNICEF framework of malnutrition



Source: UNICEF 1990

Appendix B: Measures of hunger and malnutrition

Indicator	Interpretation	Most common means of reporting
1: Measures of hunger		
Proportion of undernourishment in a population	An indicator of inadequate calorie availability, access or intake. Reducing this is a Millennium Development Goal indicator.	Percentage of individuals with food availability, access or intake of calories below some threshold.
2: Anthropometric measures of malnutrition		
Prevalence of low birth weight (LBW)	An indicator of intrauterine growth retardation resulting from short maternal stature, poor maternal nutrition before or during pregnancy, infection and smoking.	Percentage of children with birthweights below 2500 grams
Prevalence of low height-for-age (stunting)	Children's skeletal (linear) growth compromised due to constraints to one or more of nutrient intake or health, often related to IYCF practices. This is an indicator of chronic nutritional deprivation.	Expressed as a z score or as the percentage of individuals stunted. Z scores are calculated by standardizing an individual's height-given-age and sex against an international standard of well nourished people. ^a Individuals with z scores below -2 are classified as stunted; with z scores below -3 are classified as severely stunted.
Prevalence of low weight-for-height (wasting)	People suffer thinness resulting from energy deficit and/or disease-induced poor appetite, malabsorption, or loss of nutrients. This is an indicator of transitory nutritional deprivation.	Expressed as a z score or as the percentage of individuals wasted. Z scores are calculated by standardizing an individual's weight-given-height and sex against an international standard of well nourished individuals. ^a Individuals with z scores below -2 are classified as wasted; with z scores below -3 are classified as severely wasted.
Prevalence of low weight-for-age (underweight)	This is a composite measure of nutritional status, reflecting both chronic and transitory nutritional deprivation. This is a Millennium Development Goal indicator.	Expressed as a z score or as the percentage of individuals underweight. Z scores are calculated by standardizing an individual's weight-given-age and sex against an international standard of well nourished individuals. ^a Those with z scores below -2 are classified as underweight; with z scores below -3 as severely underweight.
Prevalence of low body mass index in adults or adolescents	Adults suffer thinness as a result of inadequate energy intake, an uncompensated increase in physical activity, or (severe) illness.	Expressed as Body Mass Index (BMI). BMI is calculated by dividing weight in kilograms by the square of height in meters. Individuals are considered to be chronically energy deficient if they have a BMI below 18.5, overweight if they have a BMI greater than 25, and obese if they have a BMI greater than 30.
3: Measures of micro-nutrient deficiency		
Prevalence of iodine deficiency	Iodine deficiency results from low intake of iodine in the diet.	Expressed by clinical inspection of enlarged thyroids or in terms of iodine concentrations in urine (µg/L). The benchmark for the elimination of iodine deficiency is to have less than 20% of the population with levels below 50 µg/L
Prevalence of low hemoglobin (anemia) in preschool, school-age children, nonlactating or nonpregnant women.	Children suffer from anemia, either as a result of low iron intakes or poor absorption, or as a result of illness. Severe protein-energy malnutrition and vitamin B12/folate deficiency can also lead to anemia. Women suffer from anemia as a result of low iron intakes, poor absorption, illness, or excessive losses of blood. Severe protein-energy malnutrition and vitamin B12/folate deficiency can also lead to anemia. Anemia is rare in adult men except in cases of extreme iron-deficient diets.	Expressed as grams of hemoglobin per liter of blood. Cutoffs to define anemia are 110 g/L for children 6-59 months, 115 g/L for children 5-11 years and 120 g/L for children 12-14 years. Cutoffs to define anemia are 120 g/L for nonpregnant women, 110 for pregnant women and 130 for adult men.
Prevalence of vitamin A deficiency	Vitamin A deficiency results from low intake of animal products containing high amounts of absorbable retinol or plant products high in beta-carotene. Diarrhoea, fevers and some infections can interfere with the absorption or Vitamin A or utilization of retinol.	Clinical deficiency is estimated by combining night blindness and eye changes – principally Bitot's spots to form a total xerophthalmia prevalence. Subclinical deficiency is assessed as prevalence of serum retinal concentrations below 0.70µmol/L.

Sources: ACC/SCN (2000a), Alderman, Behrman and Hodidinott (2004), Allen and Gillespie (2001), Gibson (1990), Millennium Task Force on Hunger (2003) and Morris (2001).

^a A z score of -1 indicates that given age and sex, the person's characteristic (e.g., height, weight-for-height, weight) is one standard deviation below the median person in that age/sex group