



## Technical Working Group on Measuring Food and Nutrition Security

# Measuring Food and Nutrition Security: An Independent Technical Assessment and User's Guide for Existing Indicators

June 2016

Uma Lele (Chair), William A. Masters (Co-Chair), Joyce Kinabo, J.V. Meenakshi,  
Bharat Ramaswami and Julia Tagwireyi with Winnie F.L. Bell and Sambuddha Goswami



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This paper supports the overall objectives of the Food Security Information Network (FSIN) to strengthen information systems for food and nutrition security and promote evidence-based analysis and decision making.

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For details on the history of this project, see: <http://www.fsincop.net/topics/fns-measurement>.

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## Introduction

This document aims to help users choose and interpret food security and nutrition indicators to guide a wide variety of policies and programmes around the world. The criteria used for this technical assessment and user's guide were developed through extensive consultations undertaken by an independent Technical Working Group (TWG) of the Food Security Information Network (FSIN).

The FSIN itself was launched in October 2012 as a partnership between the Food and Agriculture Organization (FAO), the World Food Programme (WFP), and the International Food Policy Research Institute (IFPRI), to help countries build sustainable food and nutrition information systems. Key organizations involved in FSIN include policymakers and government agencies; civil society, media, academic bodies and advocacy groups; bilateral donors, multilateral organizations, international agencies, philanthropic entities and their implementing partners at various scales. These FSIN stakeholders are the intended audience for this report. Each reader is likely to have unique needs and interests, but can benefit from a shared understanding of how best to measure the many dimensions of food security and nutrition.

This TWG was established by FSIN in November 2014, to help users interpret and improve existing measures of food and nutrition security ([FSIN 2015](#)). The TWG was charged with developing this technical assessment and user's guide as a reference work, structured to help practitioners find helpful information in an accessible and compact format, based on widely-used conceptual frameworks. TWG members bring a wide range of experiences in agriculture and nutrition to their authorship of this document, which also reflects input from many others all around the world. A key lesson from this experience is that measurement needs and tools evolve over time and vary across space. Policymakers and researchers are continually pursuing new metrics, which then drive new data collection efforts at different speeds in different locations. This document is intended to complement readers' own knowledge of their own circumstances, to spread best practices and improve every country's use of the best available food security and nutrition indicators.

## Background and motivation

The purpose of this document is to assist policy and program planners and implementers, designers and managers, evaluators and analysts to target interventions and measure progress in food security and nutrition. Indicators for concepts such as

stunting and wasting, diet diversity and nutrient adequacy or food insecurity have proliferated in recent years, leading to widespread confusion about the best indicators for any given situation. Relatively few of the many available measures of food security and nutrition have been mainstreamed by governments and international organizations with a broad country coverage, on a sustainable basis. This technical assessment and user's guide aims to help readers choose among available indicators, and apply the results in their work to improve agriculture, food security, nutrition and health.

Given the diversity of policies and programs in various circumstances around the world, no single set of indicators can fit all needs. Some purposes call for international agreement on specific indicators, such as monitoring countries' progress towards Sustainable Development Goals (SDGs), or allocating resources among humanitarian crises. But country-level policy and program indicators may vary with local circumstances and the specific objectives of each decision-maker. Our technical assessment and user's guide is designed to respect this diversity. Instead of a narrowly targeted, one-size-fits-all recommendation, we aim to provide helpful guidance over the full range of measurement needs in food security and nutrition.

The scope of our report is defined by the terminology adopted at the World Food Summit of 1996, which states that "food security exists when all people at all times have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life" ([FAO 1996](#), [FAO 1996a](#)). In 2009, at the World Summit on Food Security ([FAO 2009](#)), the definition was modified to be "physical, social and economic access", adding that "The four pillars of food security are availability, access, utilization and stability".

In keeping with these definitions, our goal is to help users measure the degree to which people actually have "*availability, access, utilization and stability*" of "*sufficient, safe and nutritious food to meet their dietary needs*" at any given place and time. We discuss this measurement problem in the context of standard conceptual frameworks and the objectives of diverse organizations seeking to improve food security and nutrition around the world, but indicators for the many causes and consequences of food security and nutrition are beyond our scope. Measurement as such is sufficiently difficult: our recommendations focus on 37 distinct indicators of food security and nutrition, each of which has several variants and can be combined into multidimensional indexes of various kinds.

To assess and recommend uses of existing indicators, the FSIN's TWG on Measuring Food and Nutrition Security engaged six members from diverse backgrounds, each contributing in their individual capacity, guided by a fourteen-member Expert Advisory



Panel (EAP), as well as the FSIN steering group. As specified in the project's Concept Note ([Lele and Masters 2014](#)) the TWG works independently of the FSIN secretariat staff, in dialogue with the project's Expert Advisory Panel and other stakeholders such as officials in the World Health Organization (WHO), the World Bank (WB), national governments, universities and civil society.

The FSIN TWG on Measuring Food and Nutrition Security builds on many previous reviews of the available indicators, from [Maxwell and Frankenberger \(1992\)](#) to [Jones et al. 2013](#), [Leroy et al. \(2015\)](#) and others, reflecting longstanding interest in the many indicators used to measure food security. Key milestones in this domain include the FAO International Scientific Symposium on Measurement and Assessment of Food Deprivation and Undernutrition in June 2002 ([FAO 2003](#)), followed by a similar convening of experts at the International Scientific Symposium on Food and Nutrition Security Information in January 2012 ([FAO 2013](#)). These and other efforts advanced the field of measurement and indicators for different purposes but did not lead to a consensus on what data to collect, by whom, and how that data should be analyzed. With the adoption of the Sustainable Development Goals (SDGs) in September 2015, the number of targets and indicators under consideration has increased even further, as detailed by the UN's Inter-Agency Expert Group on SDG Indicators ([IAEG-SDGs 2016](#)). Links between this User's Guide and the evaluation of SDG2 were discussed with Rome-based UN agencies in November 2015 ([IFAD 2015](#), [Masters 2015](#)). Concurrent efforts are underway in Africa to develop continent wide indicators through the Malabo Declaration and CAADP, and this document has benefited from FSIN TWG engagement in that process through the African Union ([FSIN-AUC 2015](#)) as detailed in [Lele and Kinabo \(2015\)](#).

The TWG's consultations found great diversity and rapid change in countries' use of indicators and ability to generate reliable data. As documented in the Global Nutrition Report ([GNR 2015](#)), some countries offer relatively data-rich environments, while others have only the most basic national accounts and very few surveys of any kind. Underlying conditions are also very diverse, leading to heterogeneity in what should be measured to guide local policies and programs. For these reasons, the FSIN's TWG is not recommending a single, one-size-fits-all set of indicators, beyond those which are used for global monitoring as in the case of the SDGs, or continental monitoring as in the case of CAADP ([Lele and Kinabo 2015](#)). Each group's goal-setting and measurement efforts are driving and responding to rapid change in data availability: we are in the midst of a data revolution driven by new technology, using satellite imagery and mobile devices and many other innovations to transform both government statistics and unofficial data sources, with a corresponding need for local dialogue about the reliability, ownership and usefulness of each data source. For organizations seeking a

single dashboard or suite of indicators to guide their work, this document could help by providing a common understanding of what each indicator actually measures. Based on the recommendations in this report, policy analysts and program managers can generate their own customized set of indicators suited to their particular needs in pursuit of global SDGs, CAADP targets, and other policy or program objectives.

## Conclusions and key messages

The primary purpose of this document is to list the detailed assessments of each indicator, for use by readers with a wide variety of needs. But all users share a commitment to improving food security and nutrition as defined at the World Food Summit of 1996, and some general conclusions can be drawn about how best to use these indicators to achieve that goal. In particular, the TWG has identified four key principles that can help guide the selection and interpretation of indicators and measurement tools. These common recommendations can be described briefly as follows:

- (a) **Measure more than calories**, to capture various dimensions of diet quality, care practices, and other factors behind food insecurity, undernutrition, obesity and diet-related disease;
- (b) **Look over the whole life cycle**, putting the critical thousand-day period of gestation and infancy in context through childhood, adolescence, adulthood and old age, identifying the specific needs of particular groups in each stage of life;
- (c) **Watch out for whole food system**, recognizing the interdependence between agriculture and the environment, food and social inclusion, nutrition and health that is needed for resilience and sustainability;
- (d) **Use data to mobilize action**, presenting appropriate indicators in useful ways. New information can overcome inertia and start new efforts to improve the food system, which in turn generates demand for better data to guide further actions.

The value and implications of these four principles can best be seen through the assessments and recommendations provided for each indicator, regarding how best to achieve each reader's distinct objectives. The document's diverse readers may use different conceptual frameworks as described below, and be targeting different causal mechanisms to achieve their objectives, but the four key messages are likely to provide a helpful common thread.

## Definitions and terminology

In this User's Guide, the TWG follows the definition of food security adopted in the World Food Summit of 1996, as amended at the World Summit on Food Security in 2009: *"Food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food which meets their dietary needs and food preferences for an active and healthy life."* ([FAO 2009](#), [FAO 2012](#)). The 2009 declaration also made explicit that *"The four pillars of food security are availability, access, utilization and stability"*.

The definition and pillars of food security approved by national governments in 1996 and refined in 2009 reflect the ongoing historical evolution of policymakers' concerns. Earlier official declarations, following the world food crisis of 1973-74, had defined "food security" more narrowly around *availability* and *stability* of food supplies on global and national markets. Then, as global food prices declined during the structural adjustment era of the 1980s, interest shifted to distributional issues within countries, so policymakers added *access* to food among vulnerable groups. More recently, increased attention to health during the 1990s and 2000s brought a focus on *utilization* of *safe and nutritious* foods needed by specific populations. The official terminology is clearly historical in nature, with each pillar and element of the definition reflecting the dominant concerns of a particular time.

The role of nutrition in food security was explicitly recognized in the 1996 definition, and has become increasingly important since then. In compiling this report, the TWG's mandate called for special attention to both undernutrition and diet-related diseases including obesity. The project's official name is the "Technical Working Group on Measuring Food and Nutrition Security." This takes account of the full history of terminology, as described by the Committee on World Food Security in its 2012 document entitled *Coming to Terms with Terminology* ([FAO 2012](#)). For practical purposes in most of our text, we abbreviate "food and nutrition security" to just "food security", and refer separately to "nutrition" when discussing the measurement of nutritional status such as anthropometry and biomarkers, or nonfood influences on food and nutrition security such as sanitation and disease.

An important aspect of the 1996 definition which has gained importance over time is the phrase *"all people, at all times"*. The recommendations in this user's guide underscore the need for indicators that can be disaggregated to specific groups and identify even very brief episodes of deprivation. This degree of granularity is important not only for equity and social inclusion, but also for accurately measuring changes in population averages in the long run. Since the current definition of food security was

adopted in 1996, researchers have identified specific developmental stages and growth mechanisms by which deprivation works, such as the lifelong consequences of adversity during gestation and early infancy. Ongoing research could potentially lead to further expansion of the 1996-2009 definition, for example to recognize the special role of prenatal nutrition for a healthy reproductive life, or consider the importance of culturally appropriate and environmentally sustainable food. Broader definitions of this type may be accepted by some researchers and practitioners, but have not yet been officially recognized in international agreements.

## Structure and content

The structure of this document is designed to help users quickly find the most appropriate information about the indicators they need. The TWG's initial inventory identified well over 150 different measures of food security and nutrition in the available literature, of which over 100 are in active use by major international organizations. Often these indicators have overlapping definitions, sometimes using different terms to describe the same observations, or using different data sources to measure the same thing.

To help users identify which indicators are best for their situation, we group indicators by what is observed, which yields a total of 33 distinct concepts to be measured. These are listed in sequence by the scale of their initial observation, starting with data that refer to a country as a whole (as in total national production and trade), a market (as in prices at a particular place and time), a household (as in a family's total food expenditure), or an individual (as in their dietary intake or anthropometry and biomarkers). Details on how these 33 kinds of indicators relate to the SDGs are provided in Annex 1, and how they relate to the universe of over 100 measures currently used by other international organizations is in Annex 2.

Confusion and controversy about measurement of food and nutrition security has arisen in part due to changing conditions in different organizations. New indicators are introduced regularly to address specific concerns, with no end in sight to the proliferation of measures proposed and used by different organizations around the world. Data sources, institutional objectives and goals have evolved over time, with older indicators being replaced by newer ones every year. Fragmentation of the information landscape can be problematic but progress is possible, as many of the newer indicators offer promising improvements to suit many users' needs. From the growing universe of measurement tools the TWG has identified 33 distinct indicators or types of indicators as the most useful measures to include in this technical assessment and user's guide. In

the TWG's judgment, each of these plays a sufficiently important role in food security and nutrition measurement to merit individual assessment for a general audience.

The shortlisting of indicators down to the 33 distinct measures discussed in this report was based on two criteria: *availability*, meaning that the indicator is in active use by one or more organizations around the world, and *relevance*, meaning that the indicator measures an aspect of food security and nutrition of significant interest to national governments and other major stakeholders. The technical assessment for each indicator was then conducted using a detailed rubric of technical criteria presented at the start of our section on assessments and recommendations. Many other indicators are of interest to specific audiences, and may be listed in Annex 2 or mentioned in the text.

To help readers make the best use of the 33 indicators specifically assessed in this report, the assessments and recommendations are organized around user needs for each kind of data. User needs may vary in part by function, such as policy or program design, implementation, monitoring and evaluation. User needs may also vary by type of institution, such as national governments and international organizations, donor agencies and civil society or advocacy groups. Individuals often work on more than one function and engage with multiple institutions. Recognizing this diversity, we do not pigeonhole users into narrow categories or disciplinary and professional silos. Instead, we focus on *user needs*, by which we mean the type of data and scale of analysis for which indicators are used.

### **The social-ecological approach to classification of data**

Our classification of the data behind each indicator is illustrated in Figure 1, which many readers will recognize as a social-ecological model of human behavior. The social-ecological model is a conceptual framework widely used in global public health ([WHO 2010](#)), including policies and programs to limit obesity ([CDC 2013](#)). It is also relevant although less commonly used in agriculture and rural development, so before turning to our assessments and recommendations we describe the approach here, and then review how this classification relates to other causal models and frameworks.

The conceptual framework illustrated in Figure 1 allows us to classify data into one of four nested categories, based on the social scale of analysis. Some users need data that is defined at the country level, typically national accounts and trade data such as Food Balance Sheets. In other cases, users want data about market conditions, where transactions may involve unknown people from various locations. Sometimes users seek data about households, typically indicators of food consumption based on the definition of a household as a group that cooks and eats together as illustrated in the photo of a typical interview-based survey. And very often users seek data about individuals,

including anthropometric measurement of body size such as the measurement of a child's height illustrated in the photo, or other measures such as weight, mid-upper arm or waist circumference, biomarkers and clinical data.

**Figure 1. The social-ecological approach to food and nutrition security measurement**

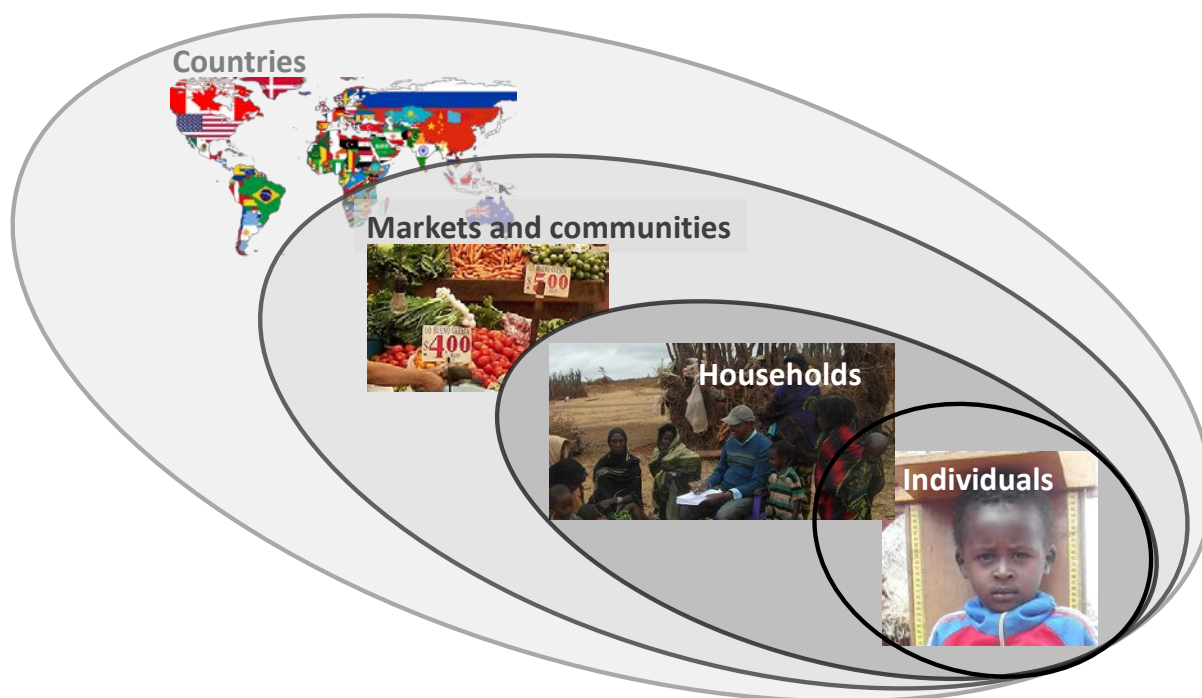


Photo credits: Country map is public domain; Market photo by Bernal (2006) licensed under CC; photos of household interview and measurement of child height are from Bekele Megersa, used by permission.

The social-ecological model and each type of data shown here can be used to classify observations in any setting, from extreme undernutrition to obesity and diet-related disease. Data from each of the four categories can be used to construct indicators at that particular scale, or aggregated up to a higher scale such as the national prevalence of individual-level malnutrition. The socio-ecological approach to food security and nutrition measurement encompasses a diverse set of relationships that operate as a system within and across scales. For example a country-level trade policy can cause changes that alter markets, households and individuals, while individual-level vaccinations or feeding can alter decisions and outcomes at household, market and country levels. Policies and programs can intervene at any scale, such as improvements in community-level marketing arrangements, and then drive changes at both larger and smaller scales over time.



Using the social-ecological model to visualize the four categories of underlying data may be particularly helpful when indicators combine measures from different scales, as in the Prevalence of Undernourishment (PoU) which includes data observed at national, household and individual scales. The social-ecological approach it is also helpful to see how some measures actually refer to pairs of people such as the mother-child dyad measured in breastfeeding indicators, or the community-level characteristics measured in water and sanitation indicators. Indicators at different scales may be combined in composite multidimensional measures, such as the Global Hunger Index (GHI) for year-to-year comparisons or the Integrated Phase Classification (IPC) system for emergency management. Because food security and nutrition data can be used in so many ways, using the social-economic model to classify indicators is helpful to focus attention on scale of observation and user needs as described below.

### **User needs and classification of the indicators**

Each of the 33 different types of indicators reviewed here measures a different dimension of food security and nutrition. To help readers locate indicators of interest to them, we group the measures into eight categories based on the scale and nature of underlying data sources. Many other classification schemes would be possible, based on concepts such as the four pillars of food security (availability, access, stability and utilization), food system functions (production, processing, distribution and consumption), or policy objectives such as the SDGs. This User's Guide focuses on data sources, so that each kind of data can be found quickly by many different kinds of readers. In the sequence below all indicators appear only once and are listed in cumulative sequence, with the simplest observations listed first followed by indicators that combine it with other data.

- 1) **National indicators** use observations that are initially made only at the country level, typically because they use national accounts, trade data, or other information that is collected administratively for the population as a whole. Analysts may then infer the share attributable to a subset of the population, but the original data source is a per-capita average. A typical example is per-capita Gross Domestic Product from national accounts, or total exports and imports from trade data.
- 2) **Market indicators** use observations that are initially made at the level of a marketplace. This could be an average over many transactions, or a single representative transaction in the market. The actual agents involved are typically unknown or anonymous, and may be located anywhere. A typical example is a market price, the total volume of sales, or the fraction of food sold that has been fortified.

- 3) **Household or individual recall data** are collected through responses to verbal or written questions. Household data refers to questions at the level of a family or other unit eating from a common cooking pot. Individual data refers to a specific person, who may or may not be the respondent. For example, a child's dietary intake is typically provided by the mother or other caregiver.
- 4) **Anthropometric indicators** are based on external measurement of body size, such as heights (or lengths) and weights. These are typically combined with other information such as age and sex, and compared to reference populations to determine a group's prevalence of stunting, wasting, overweight or obesity. Other widely used measurements include waist circumference or waist-to-hip ratio (to indicate abdominal adiposity) and mid-upper arm circumference (to track underweight).
- 5) **Prevalence of undernourishment** (PoU) and related measures are constructed by combining data observed at the national, household and individual scale. For the PoU, country-level estimates of food production, trade and other uses are used to infer total national food supply. Inequality in access and distribution of food is measured using household surveys, and compared to the population's dietary energy needs based on their age, sex and height. The result is a compound measure in which year-to-year changes in food supply can be compared to each population's energy needs.
- 6) **Biomarkers and clinical data** are health indicators based on tests of physical samples or information from clinical service providers. Samples may be collected during home visits, at mobile field sites such as village health days, or in clinics and health facilities. For example, blood tests are used to determine anemia and vitamin A status, stool samples reveal presence of intestinal parasites, and maternity service records reveal the prevalence of low birth weight.
- 7) **Breastfeeding and sanitation measures** are obtained from interviews and direct observation, often collected alongside other household and individual recall data but using different survey instruments due to their distinct unit of observation. For example, breastfeeding indicators are specific to a mother-child dyad, and sanitation indicators often refer to the shared environment of each household. Other indicators such as female education rates may come from administrative records rather than household surveys.
- 8) **Composite indexes and multidimensional measures** are created by combining different concepts into a single ranking or classification. The weights assigned to each element reflect its relative importance for users of the index, which is typically designed for advocacy purposes rather than operational use.



The sequence of eight categories listed above is based on the scale of observation for each data source. Classifying indicators in this way ensures that each indicator appears only once, so that a wide variety of users can quickly find the measurement tools they need.

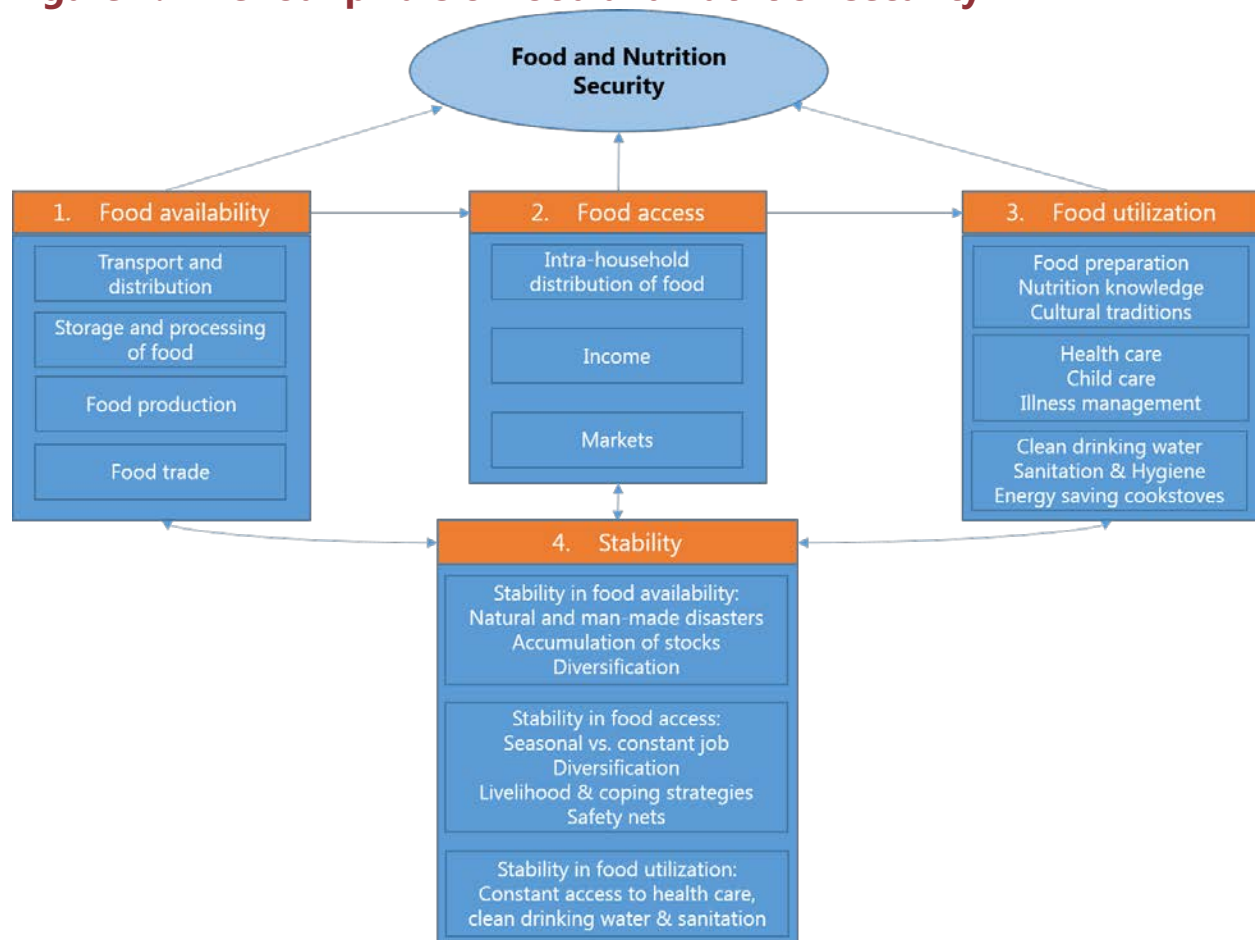
### **Conceptual frameworks and causal pathways**

This user's guide aims to help readers interpret existing indicators to meet a wide range of policy and program objectives, in diverse institutional settings. To see each indicator in context, it is helpful to visualize how the various dimensions of food and nutrition security fit together in conceptual frameworks and causal pathways used to guide interventions in recent years.

### **The four pillars of food security**

A first approach to visualizing inter-relationships between aspects of food and nutrition security focuses on the terminology adopted at the World Summit on Food Security of 2009, whose concluding declaration stated that "*The four pillars of food security are availability, access, utilization and stability*". These four pillars can be seen literally as vertical supports that raise the level of food and nutrition security. For example, Figure 2 places three of the pillars in parallel, and shows how each of them can have different degrees of stability.

**Figure 2. The four pillars of food and nutrition security**



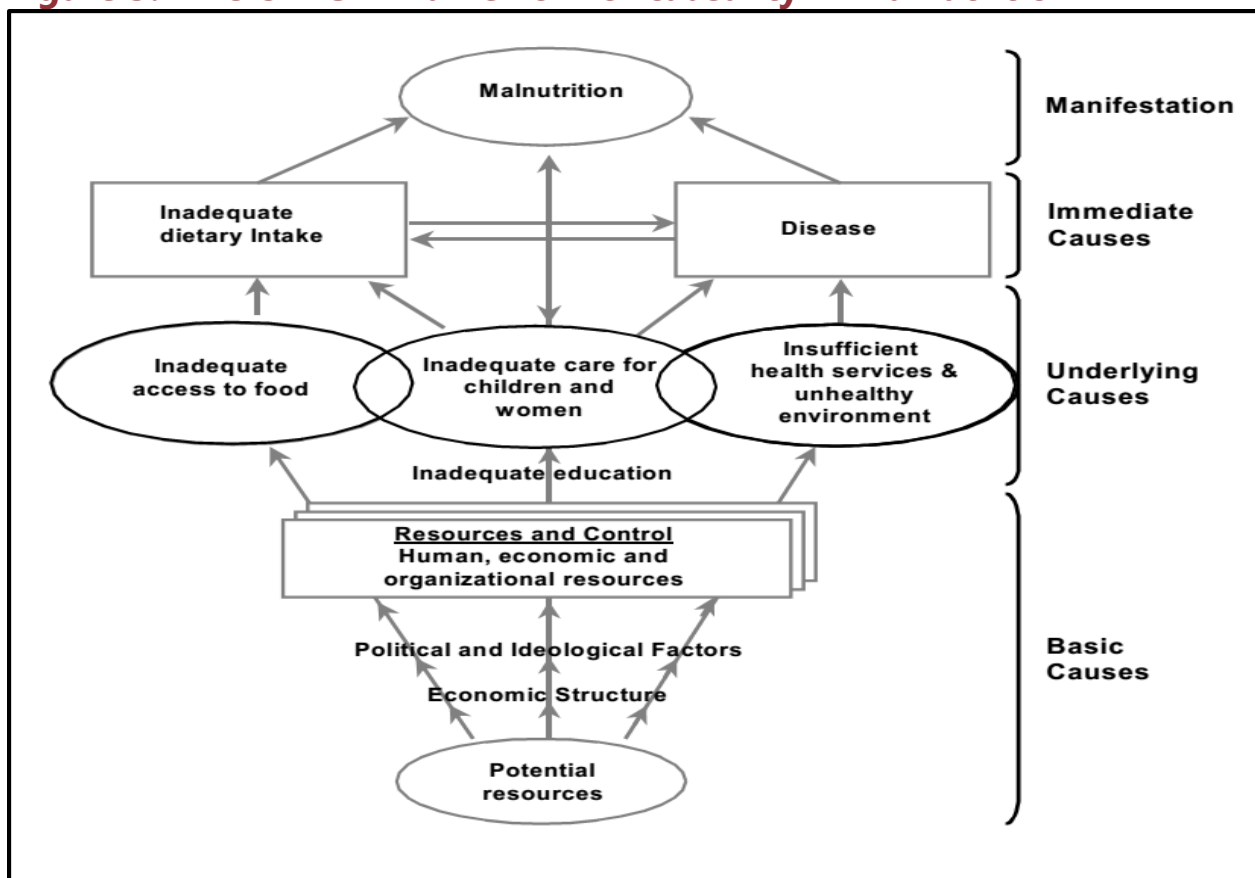
Source: [Burchi, Fanzo and Frison \(2011\)](#).

In Figure 2, each pillar also plays a direct role supporting food and nutrition security, and also contributes to other pillars. Causality between the first three is shown here to run from left to right, although there could also be reverse causality from right to left, particularly through the dimension of stability. Measuring instability often involves composite measures based on multiple indicators, with data-analysis systems for early warning and priority setting for humanitarian assistance such as the multi-agency Integrated Food Security Phase Classification ([IPC 2015](#)) or the World Food Program's Consolidated Approach for Reporting Indicators, CARI ([WFP 2015](#)).

## **The immediate and underlying causes of malnutrition**

The four pillars approach illustrated above reflects a sequence of historical concerns from the 1970s (availability and stability), 1980s (access) and 1990s (utilization). An alternative approach distinguishes between the immediate or proximate causes of malnutrition, and more remote, ultimate or underlying and basic causes. This type of flow chart was popularized by the nutrition strategy framework of [UNICEF \(1990\)](#), illustrated below.

**Figure 3. The UNICEF framework of causality in malnutrition**

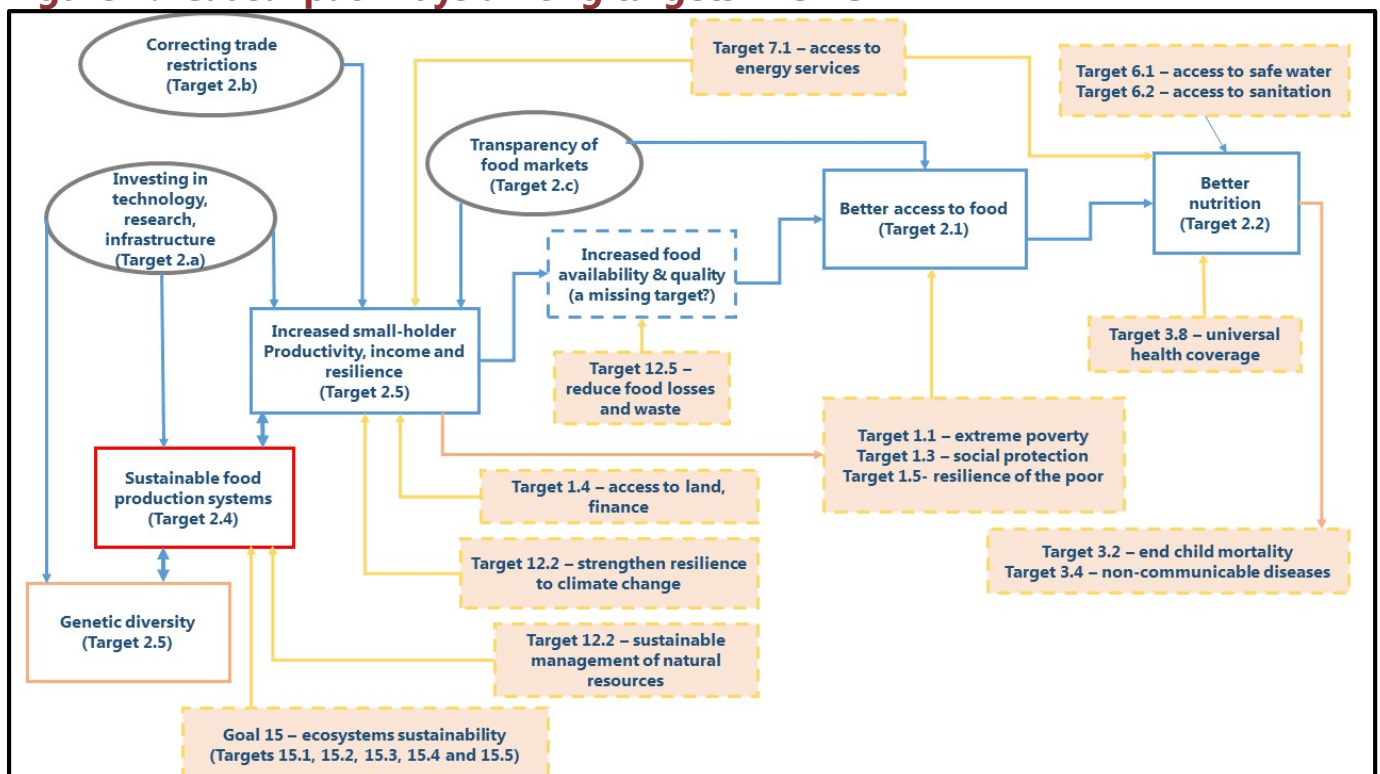


Source: [UNICEF \(1990\)](#).

## Causal pathways and system dynamics

The frameworks illustrated in Figure 3 aim to describe socioeconomic relationships before policy interventions, to help motivate and mobilize action. Once agreements are made to act, for example through the Sustainable Development Goals or World Health Assembly targets, policymakers and program managers are particularly interested in relationships among their objectives. Each agreement specifies a set of measurable endpoints, calling for conceptual frameworks that show each target explicitly in a flow chart of causality between them, as shown in Figure 4.

### Figure 4. Causal pathways among targets in SDG2

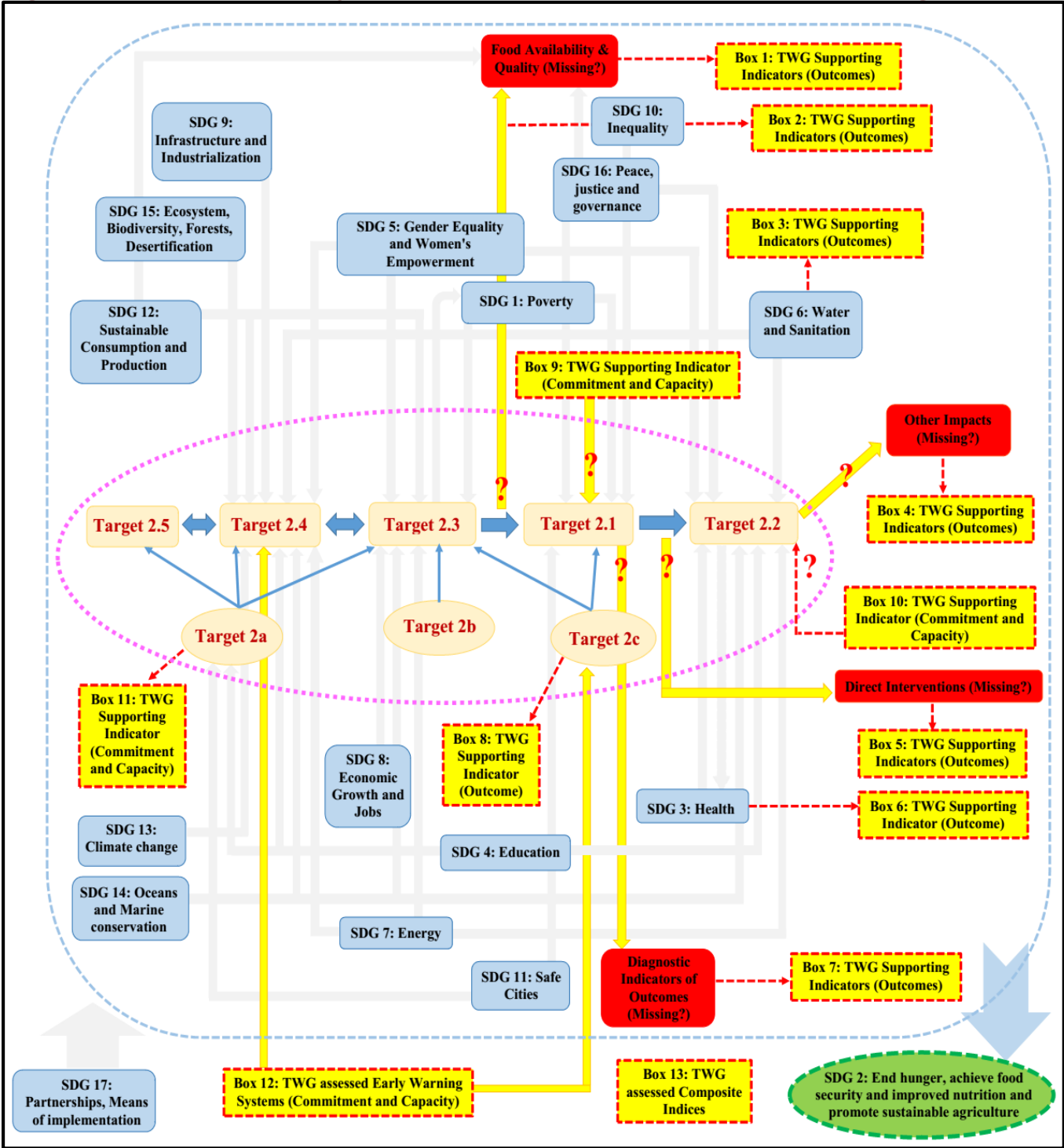


Source: Cafiero and Gennari (2015)

The figure above illustrates how the different targets specified as part of SDG2, which calls for all UN member countries to "end hunger, achieve food security and improve nutrition, and promote sustainable agriculture". These are detailed in Annex 1. SDG2 is specifically about food security and nutrition, but the targets specified under other SDGs are also important for success in this domain, including especially progress on climate change (SDG13), water and sanitation (SDG6) and empowerment of women (SDG5). The inter-relationships of SDG2 with these other goals is illustrated below, showing how

each type of indicator assessed in this document relates to the different goals. The boxes listed in Figure 4 are explained in Box 5 with further details in Annex 1.

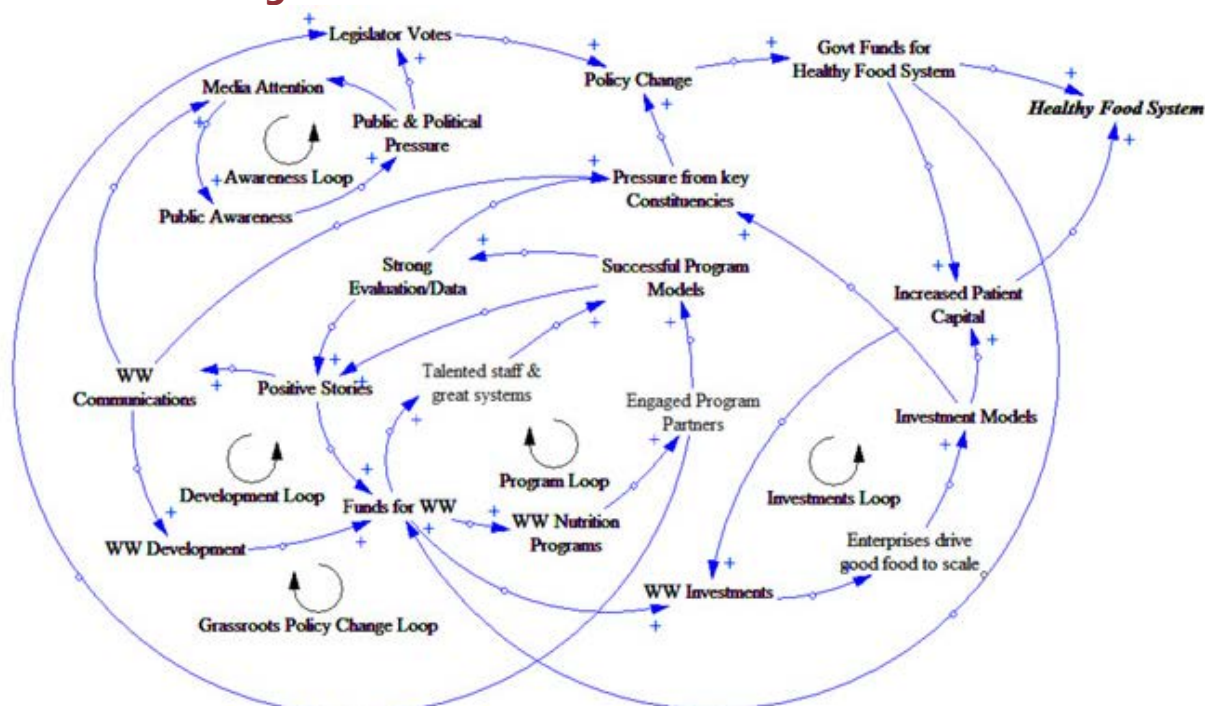
**Figure 5. Causal pathways between SDG2 and other development goals**



Source: Lele and Goswami (Oxford University Press, forthcoming). Note the numbered boxes refer to Annex 1 of this report.

The linkages among SDGs shown in Figure 5 above are sometimes captured using conceptual frameworks known as system dynamics models, as in Figure 6 below. The system dynamics tradition of visualization uses + and – symbols to illustrate positive or negative feedback from one variable to another, in this case to show changes in the U.S. food system targeted by a non-governmental organization known as Wholesome Wave (WW), using fruit and vegetable consumption to improve public health.

**Figure 6. System dynamics from food-based interventions to nutritional change**



Source: [Ross \(2014\)](#).

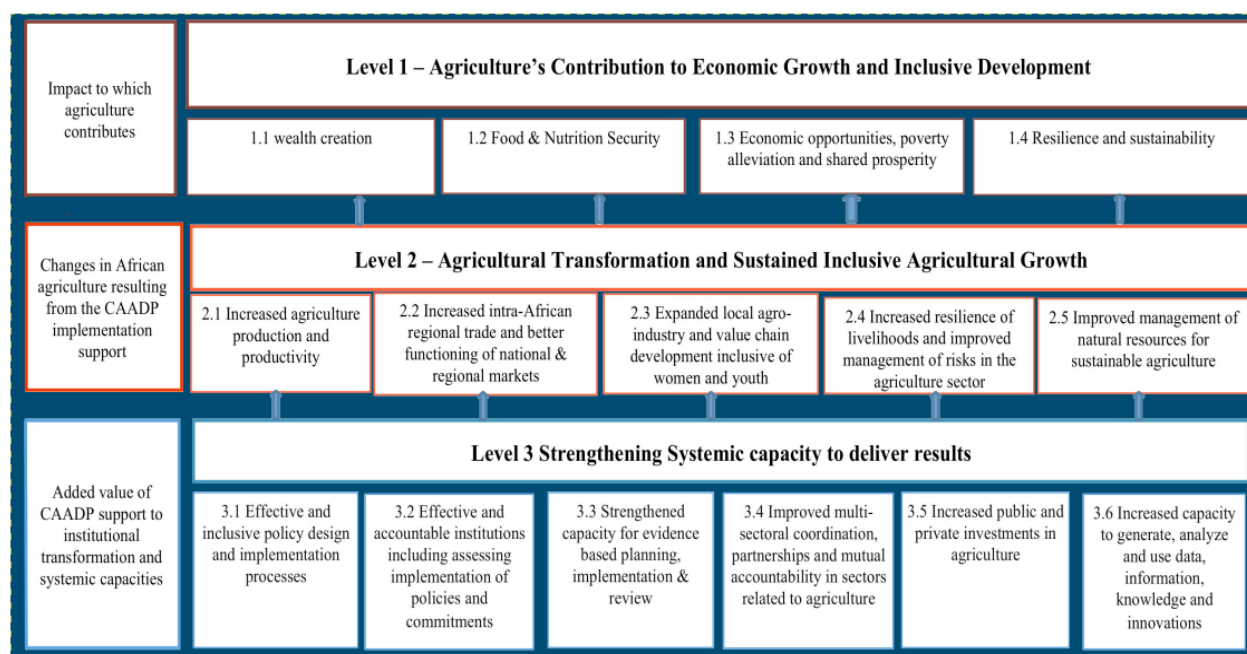
The examples in Figures 2-6 illustrate the diversity and complexity of causal pathways involved in reaching each organization's strategic objectives. Ultimately, many organizations choose the simpler approach of listing a few main goals, as in the six targets adopted by the WHA (2012). Any simplification reduces realism and detail, but may be easier to communicate and monitor. Whatever theories of change and causal pathways may be in use, the main contribution of measurement is to understand the magnitude of change. These can vary widely. For example, each of the six WHA targets has a different goal to be achieved by 2025, namely a 40% reduction in the number of children under-5 who are stunted, 50% reduction of anemia in women of reproductive age, 30% reduction in low birth weight, no increase in childhood overweight, increase to at least 50% the rate of exclusive breastfeeding in the first 6 months; and reduction to and maintenance below 5% in the rate of childhood wasting ([WHO 2015](#)).



## Result frameworks to list objectives, outcomes and impacts

Once a program or project is funded to pursue targets such as those discussed above, actual work is often guided by a results framework such as the figure below, which shows the objectives adopted under the Comprehensive Africa Agriculture Development Programme (CAADP) for 2015-25. This framework provides African governments and their development partners a specific set of results to be pursued in the transformation of the agriculture sector. The framework allows each specific objective, intermediate result, measurable outcome and development impact to be identified and measured, thereby serving as a basis for evidence-based policy and programmatic design, implementation, reporting, accountability and learning.

**Figure 7. The CAADP Results Framework**



Source: [NEPAD Planning and Coordinating Agency \(2015\)](#)

## Listing of all indicators discussed in this user's guide

This technical assessment and user's guide aims to help readers interpret and improve measurement when using many different conceptual frameworks such as those illustrated above. The indicators reviewed here can be organized in various ways. For example the text box below lists all of the indicators in terms of the four pillars as defined most recently at the 2009 World Summit on Food Security ([FAO 2012](#)).

**Box 1. Indicators assessed by the TWG in terms of the four pillars**

Availability	Access	Utilization	Stability
<ul style="list-style-type: none"> <li>▪ Government Expenditure Share on Agriculture</li> <li>▪ Dietary energy in the food supply (kcal/capita, or percent of requirements)</li> <li>▪ Dietary quality of the food supply (g/capita of specific foods or nutrients)               <ul style="list-style-type: none"> <li>-- Average supply of protein (grams/cap/day)</li> <li>-- Protein from animal sources (grams per capita per day)</li> <li>-- Share of calories from non-staples (%)</li> </ul> </li> <li>▪ Dietary energy from household expenditure surveys (HES) ((kcal/day per adult equivalent, or percent of requirements)</li> <li>▪ Diet quality indexes (ratios, indexes or quantity/day of specific foods or nutrients)               <ul style="list-style-type: none"> <li>-- Healthy Eating Index</li> <li>-- Healthy Item Score</li> <li>-- Unhealthy Item Score</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>▪ Diversity of the food supply (index of functional attributes or food sources)</li> <li>▪ Diversity of foods available in local markets (number of distinct foods or food groups)</li> <li>▪ Dietary diversity (number of food groups, or percent with low diversity scores)               <ul style="list-style-type: none"> <li>-- Household-level measures                   <ul style="list-style-type: none"> <li>&gt; Household Dietary Diversity Score</li> <li>&gt; Food Consumption Score</li> </ul> </li> <li>-- Individual measures                   <ul style="list-style-type: none"> <li>&gt; Infant and Young Child Dietary Diversity Score</li> <li>&gt; Infant and Young Child Minimum Acceptable Diet</li> <li>&gt; Minimum Dietary Diversity for Women</li> </ul> </li> </ul> </li> <li>▪ Share of public budget spent on nutrition and allied programs</li> </ul>	<ul style="list-style-type: none"> <li>▪ Drinking water: use of clean water sources (percent of households)</li> <li>▪ Open defecation: Use of toilets (percent of households)</li> <li>▪ Birth timing (maternal age at first birth, months between births)</li> <li>▪ Women of reproductive age short stature (percent low height)</li> <li>▪ Women of reproductive age thinness (percent low BMI)</li> <li>▪ Anemia among women and children (percent of population)</li> <li>▪ Iodine deficiency (percent)</li> <li>▪ Vitamin A deficiency and supplementation coverage (percent of pre-school age children)</li> <li>▪ Breastfeeding: initiation, exclusivity and continuation (percent of children)</li> <li>▪ Iodized salt consumption (percent)</li> <li>▪ Oral rehydration (percent of under 5 with diarrhea receiving ORS, percent of cases)</li> </ul>	<ul style="list-style-type: none"> <li>▪ Volatility of food prices (standard deviations of prices over time)</li> <li>▪ Per capita food supply variability</li> </ul>



**Box 1 (continued)**

Availability	Access	Utilization	Stability
<ul style="list-style-type: none"> <li>▪ Experienced-based Scales               <ul style="list-style-type: none"> <li>-- Household Hunger Scale (HHS)</li> <li>-- Household Food Insecurity Access Scale (HFIAS)</li> <li>-- Food Insecurity Experience Scale (FIES)</li> </ul> </li> <li>▪ Nutrient adequacy (percent of requirements for specific nutrients), intake or density</li> </ul>	<ul style="list-style-type: none"> <li>▪ Right to food</li> <li>▪ Food price indexes (local food prices relative to other prices)</li> <li>▪ Right to Food</li> <li>▪ Food affordability indexes (food prices relative to labor wages or income)</li> <li>▪ Household food expenditure (share of total spending)</li> <li>▪ Prevalence of Undernourishment (PoU) (percent of population, or millions of people)</li> <li>▪ Depth of food deficit (kcal/capita/day, based on Prevalence of Undernourishment data)</li> <li>▪ Oral rehydration (percent of under 5 with diarrhea)</li> </ul>	<ul style="list-style-type: none"> <li>▪ Adult and adolescent Body Mass Index (percent underweight, overweight or obese)</li> <li>▪ Child height and stunting: height-for-age (percent of children, or mean height)</li> <li>▪ Child weight and wasting: weight-for-height and MUAC (percent of children)</li> <li>▪ Child underweight: weight-for-age (percent of children)</li> <li>▪ Child weight and overweight (percent overweight)</li> <li>▪ Low and very low birthweight (LBW and VLBW) (percent of births)</li> <li>▪ Diarrhea -- Incidence of food and waterborne diarrhea (percent of children)</li> <li>▪ Adult raised blood glucose (percent)</li> <li>▪ Adult raised blood pressure (percent)</li> <li>▪ Adult raised cholesterol levels (percent)</li> </ul>	

Combinations of indicators are used by humanitarian agencies to steer their interventions to particular countries at particular times, just as multidimensional indexes are used by development agencies to rank countries and measure progress from year to year. The evolution of concepts and measurement is led by policymakers and program managers, but involves significant scientific input most notably from a sequence of publications in *The Lancet* ([2008](#), [2011](#), [2013](#) and [2015](#)). These scientific steps were taken alongside policy changes such as the SUN initiative, the UN Secretary General's zero hunger initiative, the second Global Nutrition Conference, the adoption of SDGs in

September 2015 and the announcement of changes in the global architecture for food and agriculture in December 2015. The second Global Nutrition Report notes that “nutrition is scarcely mentioned in the Sustainable Development Goals (SDGs)”, showing that obesity is not mentioned at all in the SDG resolution, only one of the SDG target and two SGD indicators mention nutrition.

The architectural changes announced in Rome in December 2015 are a response to increasing focus and coordination among often uncoordinated and competing organizations. A major issue in that process is avoiding indicator overload by establishing clear priorities around a limited number of measures. At the December 3<sup>rd</sup> consultation in Rome, for example, Morocco's Ambassador to Rome Mr. Hassan Abouyoub pointed out that there are over 600 indicators in SDGs, which are far too many for any agency to track. An example of a more narrowly targeted approach is that adopted by the World Health Assembly, which identified a much shorter list of just six measurable targets to be reached by 2025 as listed above.

For the broader agenda of food and nutrition security, the SDGs help to conceptualize and guide policies and programs, but are not themselves a framework for measurement. As described by [Cafiero and Gennari \(2015\)](#), the SDG's “theory of change is weak on measurement particularly those related to the measurement of productivity and environmental sustainability”. To improve measurement we must turn to detailed assessments of individual indicators, in the following section of this report.

## Assessments and recommendations

This section of the User's Guide provides assessments and recommendations for how best to use each indicator. Each is presented in sequence following the social-ecological approach as described above. Indicators are grouped into one of eight categories based on the underlying data source, and each may be used in various ways. Assessments are provided here for a total of 33 types of indicators, drawn from the growing universe of over 100 measures in current use as described in Annex 1 and 2. In addition to the 33 individual indicators we also discuss four composite indexes that combine multiple indicators in various combinations.

The indicators listed here were selected based on two criteria: *availability*, meaning that the indicator is in active use, regularly collected by one or more organizations and could potentially be adopted by readers of this User's Guide, and *relevance*, meaning that the indicator is of special interest to organizations in the domain of food security and nutrition. Many indicators of undoubted importance are omitted from this report. For example, we do not address the measurement of food insecurity's many causes such as

poverty and climate change, or its many consequences such as psychological stress and ill-health. These are considered out of scope for this particular document, following the TWG's mandate to produce a compact document with recommendations about the measurement of food and nutrition security in particular. To judge whether a given indicator is in scope for this User's Guide, the TWG relied on the World Food Summit 1996 definition of food security, as modified in 2009, augmented by more recent dimensions of nutrition security such as sanitation and diet-related disease.

For each indicator described below, the working group's technical assessment followed the rubric of criteria listed in the box below. The TWG's assessments began by identifying the domain being measured, which might be food in general (measured, for example, in terms of weight, value or total dietary energy per capita) or nutritional aspects of food (which would be measured in terms of a particular food, nutrient or at-risk population group). Indicators not in either domain were omitted from further review. The next set of criteria concerns units of observation, in terms of the scale and time period of observation. This information was then used to classify the indicators in terms of their data sources, which range in scale and scope from national accounts that are country-level data for an entire year, to individual data at a particular day and time.

After each indicator was classified, its validity was assessed using the rubric listed in the text box. First, the TWG asked whether there is a "gold standard" against which to compare the indicator. For example, indicators of dietary intake are often based on dietary recall or food frequency questionnaires rather than the gold standard of recording everything that is consumed at each meal, because food diaries or direct observation of actual quantities is impossible to do in field settings. Some indicators are constructed from direct measurements of the underlying concept, such as heights and weights, which are then transformed into an indicator such as stunting prevalence by reference to a benchmark such as the WHO growth standards. In each case, the TWG assessed the indicator's validity in terms of *scientific validity* relative to known gold standards, as well as statistical accuracy in the sense of both *specificity* and *sensitivity*. An indicator is said to be *specific* if it changes only when the underlying concept changes, and *sensitive* if it always changes when the underlying concept does. Other criteria for validity include *transparency* so that users can follow any change in the indicator back to the original data, and *comparability* so that changes observed at one time or place can be compared to other populations.

Finally, the TWG's assessments for each indicator included several questions about the difficulty of data collection and use, notably its relative cost, temporal frequency and spatial density of observation, institutional sustainability and timely accessibility by end-users. Each assessment aims to address users' concerns about the indicator's value in

terms of relevance and significance, legitimacy and trustworthiness, ease of interpretation, redundancy relative to other indicators, and granularity with respect to socioeconomic groups.

## Box 2. Assessment criteria for indicators reviewed in this User's Guide

<b>Name of indicator (units of measurement)</b>	
<b>Assessment criteria</b>	<i>Does or could this indicator measure something that...</i>
<b>Domain</b>	
Food security	<i>...is about availability and access to food in general?</i>
Nutrition security	<i>...is about utilization of healthier foods and care practices?</i>
<b>Scale and scope</b>	
Scale of observation	<i>...uses national, subnational, household or individual data?</i>
Time frame	<i>...uses annual, seasonal, monthly or daily observations?</i>
<b>Validity</b>	
Scientific validity	<i>...aligns with a known gold standard of measurement?</i>
Statistical sensitivity	<i>...changes when the underlying concept change?</i>
Statistical specificity	<i>...changes when the underlying concept does not?</i>
Transparency	<i>...uses clear sources of data, weighting and methods?</i>
Comparability	<i>...uses appropriate application of standard methods?</i>
<b>Difficulty of data collection and use</b>	
Cost of collection	<i>...has low, medium or high cost relative to other measures?</i>
Frequency	<i>...has consistently and frequently updated data sources?</i>
Spatial density	<i>...uses enough locations to capture spatial variation?</i>
Sustainability	<i>...has staffing and resources assured from year to year?</i>
Timely accessibility	<i>...is disseminated to users quickly after events occur?</i>
<b>Usefulness</b>	
Relevance	<i>...is within the FSIN users' scope of responsibility</i>
Significance	<i>...has with clear implications for FSIN users' actions</i>
Ease of interpretation	<i>...can be readily understood and communicated?</i>
Political legitimacy	<i>...is in WHA targets, MDG/SDGs or other agreements?</i>
<b>Covariance</b>	<i>...correlates closely with other indicators, so is redundant?</i>
<b>Gender/age sensitivity</b>	<i>...can be disaggregated by sex, age and other groupings?</i>

## **National observations**

Indicators in this category are based on data collected at the national scale. Data collected at the individual, household, or local scale can be aggregated up to the national scale, but here we refer to observations which are made directly at the scale of a whole country, using administrative data such as national accounts or trade records.

### **Dietary energy in the food supply (kcal/capita, or pct of requirements)**

The total quantity of all foods consumed by people in a country is typically measured by the sum of dietary energy per person. Estimates obtained at the country level are produced from each government's agricultural statistical service estimates of total production by crop or livestock species, plus imports minus exports, other uses, and an estimate of food waste. The authoritative source of such estimates for all countries of the world is the FAO's Food Balance Sheet database ([FAO 2015d](#)). The US Department of Agriculture also maintains its own estimates for all countries and regions, known as the Production, Supply and Distribution (PSD) database ([USDA 2015](#)).

In FAO Food Balance Sheets, the sum of crop and livestock products estimated to have been consumed by people is labeled food supply. National totals are divided by the country's estimated population in each year, to produce a per-capita average ([FAO 2001](#)). In principle, a country's estimated food supply in Food Balance Sheet (FBS) data would differ from the sum of all individuals' dietary intake only by the amount of kitchen and plate waste, since the FBS already includes an estimate of food lost during distribution and processing. In practice, the FBS data have many limitations (e.g. [Pangaribowo, Gerber and Torero 2013](#)), and there are numerous differences between FBS data on mean consumption and survey data on average intake ([Del Gobbo et al. 2015](#)). Collecting better data from individuals is much more expensive and complex than assembling FBS data, however, and very few countries have regular nationally-representative surveys with which to produce national indicators of dietary intake. Even the most costly efforts such as the United States' National Health and Nutrition Examination Surveys, NHANES ([CDC 2015c](#)) suffer from limitations imposed by budget constraints ([Orcholski et al. 2015](#)). Until those problems are solved, the FBS approach to estimating per-capita consumption will remain widespread.

The total dietary food supply of each product may be measured in terms of weight (kg) or volume (liters). Since foods differ greatly in their moisture content, dietary fiber and other components, the total amount of food is typically added up in terms of dietary energy per person (kcal/capita). This measure of total consumption provides the foundation for several other indicators of food security and nutrition. For example, the

FAO computes a measure called Average Dietary Energy Supply Adequacy (ADESA), defined as the ratio of dietary energy consumed to the Average Dietary Energy Requirement (ADER) of the country. This measure is published as part of the [FAO \(2015\)](#) suite of food security indicators developed for the annual State of Food Insecurity (SOFI) report. In the FAO methodology, ADERs differ by country due to differences in their sex-age composition and attained height. All people of a given sex, age and height are estimated to have the same energy requirement, but countries where a larger share of the population are children, elderly, or relatively short for their age and sex will have lower population-level ADER. To compute ADESA, Food Balance Sheet estimates of dietary energy supply divided by ADER estimates of dietary energy requirements are multiplied by 100. Ratios higher than 100 indicate estimated food supply above requirements, while ratios less than 100 indicate food supply below requirements.

### **Dietary quality of the food supply (g/cap of each nutrient or food)**

A population's access to specific nutrients can be measured in the same way as their access to dietary energy, using food balance sheets combined with food composition tables. The FAO does this regularly for macronutrients, allowing users of FBS data to add up total fats or total protein, and compute many related measures of diet quality ([FAO 2001](#)). Like any population average, the mean per-capita level of any variable can be misleading, since nutrients are not distributed uniformly and individuals could be malnourished even in a group whose average intake is adequate. A country's average is the sum of all those individuals, so food balance sheets can be used to indicate population-level dietary patterns including the level or share of dietary energy from particular food groups, such as fruits and vegetables, milk and meat, or all non-staples (foods other than cereal grains and starchy roots). The supply of specific nutrients from particular foods may also be important, such as protein of animal origin, for which early intake has been linked to linear growth in children ([de Onis et al. 1993](#)).

Consumption of particular food groups is important for both macronutrient and micronutrients, including the quality of dietary protein and fats, and also important for food attributes such as fiber and antioxidants or other components of a healthy diet. Specific food groups are also important for cultural reasons of taste and preferences, which is integral to the 1996 definition of food security ([FAO 1996](#)). In situations of widespread undernutrition, increased consumption of foods other than starchy staples may be the most important step towards higher quality diets and hence nutrition security, while in other settings the main diet quality concern may be excess consumption of refined carbohydrates, sugar-sweetened beverages, sodium or other risk factors for obesity, diabetes, hypertension, cardiovascular and other diseases.



In terms of macronutrients, in many settings the aggregate supply of protein may be less of a constraint on health than the quality of protein. The literature suggests that protein quality is an important indicator in itself and a predictor of health outcomes ([Ghosh, Suri and Uauy 2012](#)). In particular, intake of protein from animal sources has been found to be protective against child stunting (e.g. [Lancet 2008](#)). This indicator might focus on milk and eggs as opposed to meat or fish. A detailed assessment of protein quality measurement is provided in the FAO Expert Working Group report: “*Research approaches and methods for evaluating the protein quality of human foods*” [FAO \(2014b\)](#).

In terms of food groups, the availability of all nutrient-rich foods can be captured by adding up the share of all non-staples in dietary energy. This is a very attractive measure of diet quality in settings with widespread undernutrition, and has deep roots in economic history and the measurement of living standards. The association between higher living standards and a lower share of starchy staples in dietary energy is known as Bennett's Law, due to observations made using data from the mid-1930s by Merrill K. Bennett ([Bennett 1941](#)). Subsequent research has confirmed that, as people in every part of the world become wealthier, they transition from diets dominated by starchy roots and cereal grains to more varied patterns including leguminous grains, vegetables and fruits, dairy products and eggs as well as meat and fish. These more diverse diets are generally associated with greater nutrient adequacy and healthier outcomes, although not always: during the late 1980s and 1990s in the United States, economic growth was accompanied by a return to consumption of starchy foods, albeit in refined and processed form, and with the proliferation of processed foods greater diet diversity is no longer correlated with other measures of diet quality ([de Oliveira Otto 2015](#)).

The advantage of diet quality indicators based on Food Balance Sheets is two-fold. First, the FBS data are routinely updated by national governments, and distributed by the FAO in a consistent format. Secondly, the FBS data are straightforward to compute and interpret as per-capita averages, without sampling and reporting biases associated with diet recall data. The major caveat concerns what national governments are reporting to the FAO for these food balance sheets. In many countries, data reporting systems for staple foods, especially cereal grains, are more developed than the estimates for other foods. Many of these issues have been documented in FAO's handbook on food balance sheets ([FAO 2001](#)). Alternative approaches using household survey data are discussed below.

## Diversity of food supply (Shannon indexes of attributes or sources)

Food balance sheet data can be used to go beyond food groups to consider other ways of measuring dietary diversity. Diversity can be important not only for human health but also for environmental sustainability and resilience. [Khoury et al. \(2014\)](#) report that over the past half-century, while each individual country's food supply and diet diversity has increased, countries have converged towards increasingly similar food patterns so that global diversity in cultivated species has narrowed. Biodiversity within individual species cultivated in each location has also declined, replaced by use of gene banks and deliberate crop breeding to re-introduce traits when needed.

To measure diversity of food production as well as consumption, researchers have introduced entropy-based indicators that build on the ecological literature; these include the Modified Functional Attribute Diversity (MFAD) and the Shannon Entropy Index which can be used with Food Balance Sheet data. These types of indicators consider not just the number of different species, but also the relative quantity of each to assess whether one or a few species predominate in a given area. The same formulas appear in the economics literature as Herfindahl indexes. For nutrition, the MFAD index of [Remans et al. \(2014\)](#) uses these entropy methods to capture diversity in terms of nutritive values: if two crops have the same nutrient content, then these are treated as if they were the same crop, and diversity is then expressed in terms of the number of food crops (and the evenness of their spread) contributing to nutrient supply. With international trade, production differs from consumption, so diversity in agriculture may differ from diversity of dietary intake.

Diversity measures using food balance sheets exploit readily available data that is updated every year, but like any national average they can be misleading: A country could have high diversity at the national level, but if each food is grown in a different part of the country each region might have very low diversity. In addition, only crops covered by the FBS can be considered, and many animal feed and forage plant species are not counted, nor are crops cultivated in kitchen gardens ([Khoury et al. 2014](#)). Diversity indexes are also fairly technical to calculate and to interpret. For these reasons, it seems unlikely that diversity indexes will become widely-used indicators of food and nutrition security in the near future, but readers should be aware of them and consider their use in settings where national average diversity is an appropriate concept.

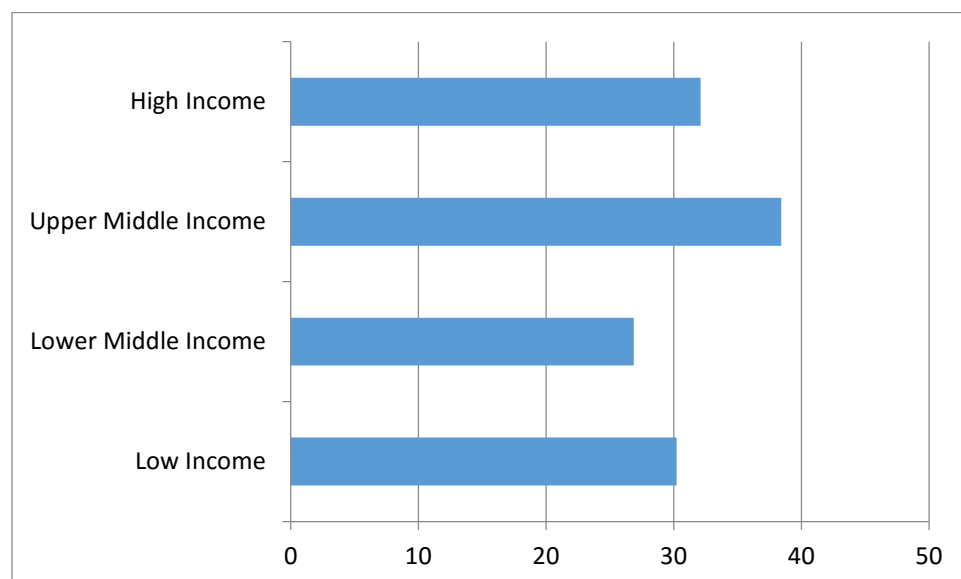


## **Variability of the food supply (std. deviations of kcal/capita over time)**

Because FBS data are updated annually, they can be used to measure year-to-year fluctuations in the food supply. The variability indicator computed annually by the FAO is each year's standard deviation over the previous five years around the trend in average dietary energy per capita. Updating each year's food supply data in a timely way is difficult to do, however, with an important tradeoff between speed and accuracy when measuring short-run changes. This tradeoff was especially important in the immediate aftermath of the 2007/08 price spike, when policymakers sought rapid estimates of changes in national food supplies that had to be revised when more accurate data became available. That experience underscores the idea that FBS are more valuable as a measure of long-term trends and differences among countries, rather than short-term fluctuations.

Variability in food supply is an outcome of underlying instability combined with behavioral responses in production, trade, consumption and storage, as well as changes in government policies such as trade restrictions, taxes and subsidies, stockholding and public distribution. Both private and public-sector response to shocks can either dampen or exaggerate volatility, and collecting data on each contributor to national food supplies takes time. For these reasons, there is no simple association of variability in food supply with the vulnerability of countries to adverse shocks. This point is illustrated by the figure below. Although food supply variability may be lower in low or middle-income countries, the costs of managing these fluctuations may be greater. At an individual level, coping strategies may include the sale of productive assets and withdrawing children from school. At a country level, the income setbacks compromise macro stability and growth. The price or cost of bearing risk is not captured by direct ex-poste measures of food supply variability. Populations with low intake levels and high budget levels are less resilient in the face of shocks, so vulnerability may be more clearly inferred from direct indicators of deprivation such as the prevalence of undernourishment or the food budget share.

**Figure 8. Food supply variability by national income level, 2006-11**



Notes: Food supply variability is for the year 2011, from FAOSTAT data over the previous five years. Income groups are low income, lower middle income, upper middle income and high-income countries and are defined following the World Bank classification.

### **Public expenditure (pct of spending, or specific commitments)**

Governance and public investment in food security and nutrition are key concerns for many readers of this User's Guide. There is no single source for indicators of this type, which usually focus on national governments but may also concern the commitments and expenditure levels of subnational and international institutions.

The main obstacle to constructing indicators of public expenditure for food security and nutrition is that expenditures are tracked by department or ministry, while food and nutrition are cross-cutting domains. In some cases there are specialized food security or nutrition program budgets within larger ministries or departments of health, education, agriculture or social welfare, but those narrowly-defined expenditure levels will not capture the impact of other spending on food security and nutrition. Spending priorities may also vary between the expenditures of central governments and local authorities or other organizations, so national budgets can be misleading. For these reasons, an expansive definition of food security and nutrition that includes all spending on health, education, agriculture, and water and sanitation may be preferred, even though this includes spending that is only tangentially related to food security and nutrition.

For national government expenditures, the International Monetary Fund (IMF) is the primary source of data for budget allocations to agriculture, health, education, nutrition, and social protection. The 2015 Global Nutrition Report ([GNR 2015](#)) notes that “Governments spend, on average, between 1 and 2 percent of their budgets on nutrition, and donors spend approximately 4 percent—far too little to meet global nutrition targets by 2025.” The Scaling Up Nutrition network ([SUN 2015](#)), which counts 55 countries as members, has set out a methodology for estimating nutrition expenditures that aims to overcome some of the obstacles identified in the GNR. The core idea is to identify and distinguish between spending on nutrition-specific programs and “nutrition-sensitive” expenditures on other programs that also impact nutrition. In aggregating the two types of expenditures, the nutrition sensitive expenditures are assigned a lower weight than nutrition specific expenditures. The GNR provides a preliminary analysis of these data for 30 countries ([GNR 2015](#)).

The FAO began global data collection on government expenditure in agriculture in 2012 ([FAO 2015f](#)), requesting that countries provide annual data from 2001, using a questionnaire using the IMF Classification of Functions of Government ([IMF 2001](#)). The second global data collection began in summer 2014. After processing the data and deriving universal statistics for reporting countries, the FAO makes this dataset available as an experimental database for the review and feedback of users. Our assessment is that this dataset is too incomplete, as well as inconsistent in terms of data coverage to serve the needs of users looking for data on individual countries. Despite their limitations for individual countries over time, the FAO estimates may be informative at the continental and global level. Furthermore, as with all of the indicators reviewed in this report, more is not always better. Some governments may have high levels of expenditure that is poorly targeted or offset by other policies leading to food insecurity and malnutrition, while others could have favorable outcomes despite low expenditure.

Overall, a major limitation of expenditure data is that they do not reflect how well funds are spent and their translation to outcomes. A key issue here is whether governments can put in place accountability mechanisms to keep spending on track. One effort to hold states to a higher standard is the movement towards right to food legislation enacted in many countries. The Right to Food (RtF) team at FAO has put together a global database on right to food legislation. Their database identifies and classifies countries according to whether they have constitutional provisions or legislation that (a) explicitly recognizes a right to food, (b) guarantees other rights that could imply a right to food, (c) includes the right to food in the Directive Principles of state policy, and (d) recognizes the primacy of international treaties with respect to human rights ([FAO 2009a](#)).

The FAO's Right to Food legislation database could be useful but does not yet provide a workable indicator of legislative commitments. A starting point is whether a country's actual food and nutrition programs have legal backing, which can also occur through rights other than the right to food. To classify legal provisions appropriately, they would have to be coded for relevant properties such as: (a) the proportion of the population that is covered by these rights (b) the provisions that apply to nutritionally vulnerable groups such as children and pregnant women (c) the provisions that guarantee equal access to women (d) the cost of accessing the legal entitlements (the documentation and procedures to prove membership of target group) (e) the economic value of the right to food (f) the scope of law extending to complementary sectors of water, sanitation, health and agriculture and (g) the mechanisms for enforcing the rights.

A right to food legislation has many relevant attributes. To construct an indicator, these attributes would have to be coded and summarized in an index. Even so, this would be an indicator based on a textual analysis. Whether intent, capacity and execution matches the legislation can only be ascertained in the field. To measure food security and nutrition itself, there is no substitute for indicators of individual and household outcomes.

## **Market observations**

### **Domestic food price index (local food prices relative to other prices)**

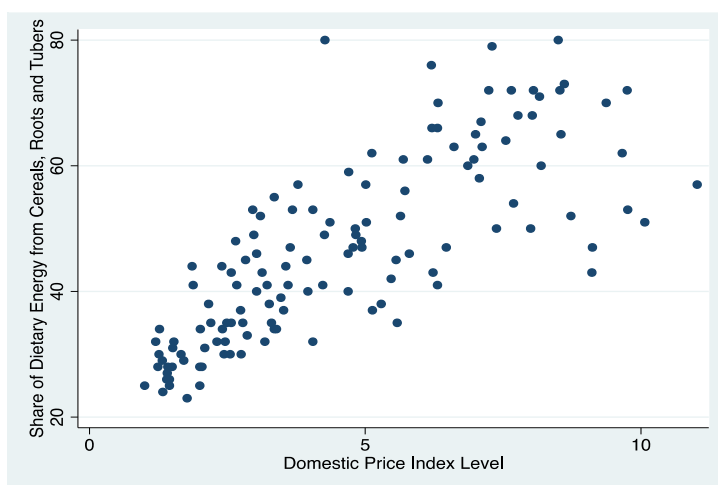
Price indicators of relevance to food security and nutrition are intended to measure access and affordability by households and individuals. Prices of bulk commodities on international markets are relevant only to the extent that they are passed through to local markets for staples such as rice, wheat or maize, and through those products to other food items. Most users should therefore use indexes of domestic food prices, ideally in retail markets close to the populations on interest. Those food prices should then be compared to the incomes and prices of other goods, to obtain the relative cost of obtaining food at each place and time.

The difficulty of obtaining meaningful food price indexes is made clear by the Domestic Food Price Index included in the FAO's suite of food security indicators ([FAO 2015](#)). This measure is defined as the average price paid by a country's households for all foods, relative to all other goods, divided by that ratio for the USA ([FAO 2015b, pg 226](#)). Such an index has a value of 1.0 for the United States in every year. For every other country the index is updated annually, with projections over time and across countries to extrapolate values that are not directly observed. Data sources are product weights and

relative prices across countries from the International Comparison Program ([ICP 2015](#)), and within countries between food and all other goods from International Labor Organization ([ILO 2015](#)).

The interpretation of FAO's Domestic Food Price Index can be seen through the actual data shown on the figure below, which plots its level for 2011 against a simple measure of diet quality: the share of energy obtained from starchy staples. The value of 1.0 for the USA turns out to be the lowest food price level in the world, appearing in the figure as the observation furthest to the left in the figure below. Some countries with higher price index levels have lower staple-food shares of dietary energy, but in general countries with higher prices of food relative have higher shares of staple foods in the diet. The correlation coefficient is 0.8.

**Figure 9. Food price levels and share of dietary energy from starchy staples, 2011**



Source: Our computations, from FAO's food security indicators for 2011

The close correlation between the FAO's Domestic Food Price Index and diet quality is linked to differences in income and real wages, as food prices set on regional and international markets are high relative to wages and the cost of housing or other services in the places where poor people live. For that reason, it may be desirable for users to seek more indicators of food prices relative to earnings and purchasing power, as described below.

## **Food affordability indexes (local food prices relative to labor earnings)**

A typical food affordability index is the ratio of wages of unskilled or low-skilled labor to the price of one or more foods. In such a ratio, the monetary units cancel out so the units of measure are hours of work needed to earn a given quantity of food. Indicators of this type are readily interpreted with clear significance for food security and nutrition of the poor. For example, if constructed to measure the hours of work needed to buy adequate calories from the least expensive starchy staple, then any reduction leaves more resources available to improve diet quality and meet other household needs.

A food affordability index of unskilled workers' purchasing power in terms of staple foods provides a market-based measure of poor peoples' food entitlements, and so provides a simple but fundamental indicator of staple food security. From the work of Amartya [Sen \(1981\)](#) and others, we know that abrupt fall in entitlements can lead to extreme food insecurity, even without a decline in food production. Such an indicator is valuable for comparisons both across countries and over time, including short-term fluctuations in emergency or other situations. It uses only market prices and wages, and can therefore be collected and updated at much lower cost than household data on quantities.

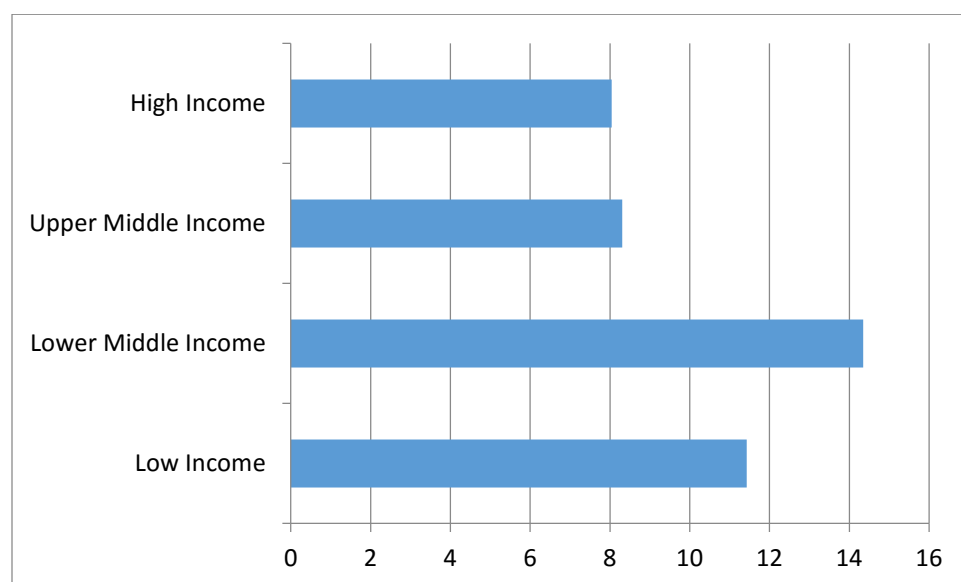
Despite the advantages of a food affordability index, it is not currently offered by any major data provider. The WFP's Vulnerability Assessment and Mapping efforts provides timely access to quarterly prices of staple foods for up to 75 developing countries in its Market Monitor, but often does not include wage data and focuses on the lowest-income nations ([WFP 2015](#)). The International Labor Organization publishes wage data and aggregate food price indexes for all countries on an annual basis ([ILO 2015](#)). From 1985 through 2008 the ILO also collected and published national data on the prices of individual foods in October of each year ([ILO 2015b](#)), but it no longer does so. Assembling a consistent database of food affordability data could be a major step forward for food security measurement, and extending this to the prices of more nutritious foods would permit the creation of new indicators for nutrition security as well. Such an indicator would be valuable for long term trends on a year-to-year basis, and also of interest for short-term fluctuations such as the volatility index described below.

## Volatility of food prices (standard deviations of prices over time)

The FAO suite of food security indicators ([FAO 2015](#)) includes a measure of month-to-month variation known as the domestic food price volatility index. This uses the FAO's own food price level index reviewed above, showing changes in variability as the standard deviation of the change in monthly prices from the preceding 8 months. The annual figure is computed as the average of monthly standard deviations over the 12 months of a calendar year. A related but different approach to measuring volatility is the ALert for Price Spikes (ALPS) indicator maintained for the WFP's Vulnerability Analysis and Mapping (VAM) food security monitoring system, which captures deviations from a seasonal trend ([WFP 2014](#)).

The caveats that applied to the food supply variability indicator also apply here: namely that (a) food price volatility is an ex-post outcome of both underlying instability and policy and (b) that it does not capture the cost of smoothing risk. Nonetheless, food price volatility and price spikes are more illuminating than food supply variability. The figure below shows that low and lower middle income countries have higher price volatility than higher and upper middle income countries even though supply variability (seen earlier) is, if anything, lower.

**Figure 10. Food price volatility by national income level, 2011**



Source: Food supply variability is for the year 2011 and from FAOSTAT. Income groups are low income, lower middle income, upper middle income and high income countries and are defined following the World Bank classification.



## **Household or individual recall**

### **Food budget share (share of total spending)**

The share of total expenditure devoted to food is among the most useful household-level indicators of food security. Its value stems from Engel's law, which is that poorer and more vulnerable people generally devote a larger share of their resources to obtaining food. Engel's law is among the oldest empirical observations in all of economics, and has consistently been found to hold both for a given individual or country over time, and also between people different people or groups at any given time.

Engel's law is a consequence of the fact that dietary energy is required for day-to-day survival, while in the hierarchy of needs other goods and services become increasingly attractive as the resources to acquire them become available. For this reason, the world's poorest people living at the margin of survival typically devote almost all of their resources to food consumption, and the foods they buy typically have the lowest cost per unit of dietary energy. With greater security people can turn to more diverse, attractive and therefore costly foods, and also add other goods and services. This relationship persists as incomes rise, with surveys finding that richer households generally spend more on food but other expenditures rise even faster, so the share of total income spent on food tends to decline.

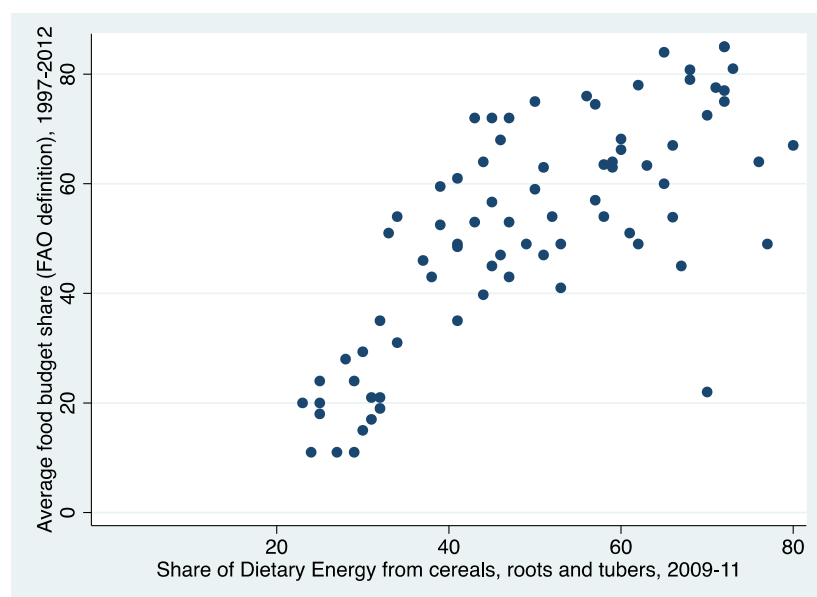
A household's share of its budget devoted to food is an attractive indicator of food security in large part because it approximates the losses experienced when food prices rise. For example, if the budget share of food were 60 percent (which is typical of poor households), then a 10 percent increase in the price of food would result in an income loss of 6 percent ( $0.6 \times 0.1$ ). For large price changes, this approximation becomes less accurate as households have opportunity to substitute away from the goods whose prices increase the most. However, such substitution behavior is not generally found for staple foods. In sum, the lower the food budget share, the less vulnerability one has to food price increases.

The FAO suite of food security indicators ([FAO 2015](#)) includes food budget shares, presented as the average share of total expenditures spent on food by households belonging to the lowest income quintile (lowest 20 percent). For reasons mentioned above, this is a very valuable indicator. The food budget share is derived from household consumer expenditure surveys and is easier to measure accurately than many other indicators, although variation in the food items covered, the inclusion of food

produced at home or consumed away from home, the period of recall and the definition of total income or expenditure can influence comparability among observations.

In the graph below, the share of energy derived from cereals, roots and tubers (2009-2011) is plotted against the FAO indicator of the average food budget share of the bottom income quintile. Because of gaps in the budget share series, the FAO indicator was averaged for the period 1997-2012 to reduce the number of missing observations. Despite this, one can observe a strong relationship between the two variables, which underlines the fact that diet diversity improves as budget shares decline.

**Figure 11. Food budget shares and diet diversification away from starchy staples**



Source: Our computations based on data from FAO's food security indicators

### **Dietary diversity (no. of food groups, or prevalence of low diversity)**

A key feature of higher quality food is greater dietary diversity, as households and individuals move from the lowest-cost sources of daily energy towards inclusion of more costly foods that meet longer term needs. The introduction of each new food into the diet is a valuable signal that a wider range of needs are being met. Asking whether or not a given food was consumed is much easier than asking for the actual quantities of food consumed.

Rapid and low-cost dietary recall surveys can capture dietary diversity data by asking whether a given food was consumed at any time over the previous 24 hours or several

days. Shorter time periods are easier to remember but food intake varies widely from day to day. Given that tradeoff, some surveys use repeated 24 hour recalls while for surveys that contact respondents only once it is generally preferable to ask for a seven-day recall. Expanding the survey to ask about quantities consumed allows measurement of total intake and nutrient adequacy, but recall of quantities is much less accurate than whether a food was consumed at all.

Dietary diversity data can be asked about an entire household or an individual within the household. The definition of a household is typically a family or other group that eats together from a common cooking facility. Since foods are shared, dietary diversity data is much easier to collect for the household as a whole than for any individual person. But nutritionally vulnerable individuals such as mothers and infants often need different foods which they may not receive, so for them an individual-level dietary diversity indicator is desirable.

When collecting and analyzing diet diversity data, individual foods are classified into groups based on their nutritional characteristics. Foods within the group are considered substitutes for each other, while different groups bring distinct and additional benefits for health and human development. The number of distinct food groups consumed thus provides a useful indicator of how many diverse kinds of nutritional needs are being met.

Most people consume some starchy staples which are almost always the lowest-cost source of dietary energy. These may be grouped together, or separated into starchy roots and cereal grains, which contain more protein than starchy roots. More costly foods that add additional nutrients of various kinds are leguminous grains, animal products, green leafy vegetables, orange-fleshed vegetables, fruits, and nuts and seeds. Consuming foods from a larger number of distinct food groups meets a wider range of nutrient needs and is generally associated with healthier outcomes, although at high levels of dietary diversity further increases are associated with more overconsumption, obesity and diet-related disease.

Given the nonlinear relationship between dietary diversity and nutrient adequacy, indicators may use a threshold number of food groups below which diversity scores are considered insufficient to achieve a nutritionally adequate diet. The appropriate threshold depends on how food groups are defined and what levels of intake are considered adequate, but people with diet diversity scores of three or fewer are generally unlikely to be meeting their nutritional needs.

*Household-level indicators: Dietary Diversity Score and Food Consumption Score*

Two specific examples of popular diet diversity measures are the Household Dietary Diversity Score (HDDS) used primarily for development policy and programs ([FAO 2012a](#)) and the Food Consumption Score (FCS) used primarily in emergency settings ([WFP 2008](#)). Both use the household as the unit of analysis, and capture its consumption of pre-specified food groups. For example, the WFP uses eight major groups: cereals and tubers; pulses; milk and dairy; meat, fish and eggs; vegetables; fruits; oils and fats; and sugar; with an additional seven subgroups considered in its extended FCS-Nutrition module ([WFP 2015b](#)). Some of the differences among diversity scores include the length of reference period, the definition and weighting of the food groups, the inclusion of food consumption frequency, and the inclusion of foods which are consumed in small amounts.

Dietary diversity can be used as a measure of overall food access, including total dietary energy as well as diet quality ([Kennedy et al. 2010](#); [Leroy et al. 2015](#)). Scores are closely correlated with other readily measured aspects of socioeconomic status and health, but measuring a person's total intake of dietary energy and other nutrients is so costly that relatively few studies have ever compared dietary diversity scores to measured intake, as in [Weisman et al. \(2008\)](#). In general, when interpreting diet diversity scores as a measure of food security and nutrition, caution should be exercised in a number of domains. There may be important differences in the frequency, quantity and quality of foods consumed within each group, and some nutritionally significant products may not be have been counted at all.

Overall, household level dietary diversity scores offer a very useful measure for use where more costly measurement methods are not feasible. Dietary diversity scores are relatively inexpensive to obtain, and so can be collected over large populations to monitor the progress of an intervention and measure disparities over time and space. Care must be taken to ensure that food groups and thresholds are locally relevant, but different measures often yield diversity scores that are highly correlated with each other and with other measures of food security and nutrition, especially in situations of greatest household-level poverty and insecurity ([Kennedy et al. 2010](#), [Lovon and Mathiassen, 2014](#)). For individuals with particular needs and in households at higher income levels, however, other measures may be helpful as detailed below.

*Individual-specific measures: Infant and Young Child Dietary Diversity Score, Infant and Young Child Minimum Acceptable Diet, and Minimum Dietary Diversity for Women*

There has long been the recognition that even if a household has adequate access to food overall, its individual members may not. Disparities within the household could arise because of differences in nutrient needs, for example during pregnancy, lactation and infancy, or because of inequality in distribution among members of the household. In general, women and young children have been found to be particularly vulnerable to undernutrition, with life-long and intergenerational consequences. Many interventions are targeted to them, calling for individual-level measures of dietary intake and health status.

Two prominent examples of individual indicators are the Infant and Young Child Dietary Diversity Score (IYC DDS) designed for children from 6 to 23 months of age, and the Minimum Dietary Diversity-Women (MDD-W) score to assess maternal diets. The IYC score measures the proportion of children who have consumed, apart from breast milk, a minimum of 4 out of a possible 7 food groups in the previous 24 hours. A related indicator, the IYC Minimum Acceptable Diet (IYC MAD) recognizes that not only do children need diverse sources of food, they also need to be fed at regular and frequent intervals. This score includes the minimum frequency of meals in addition to the minimum number of food groups consumed. These are but two of a large range of measures available that address this age group; for example, these scores may be modified to focus on foods that are rich in iron ([WHO 2008](#)), and have been validated against other measures of nutritional status ([Dewey et al. 2006](#)).

To capture maternal nutrition, the Minimum Dietary Diversity-Women (MDD-W) generally counts the proportion of women who have consumed a minimum of 5 out of a possible 9 food groups over the previous 7 days. That threshold and the food items in each group are the outcome of multi-agency consultation ([FAO, 2015c](#)), building on extensive validation against other measures (see for example, [Arimond et al. 2010](#) and [Ruel et al. 2013](#)).

Individual-specific measures of diet diversity are generally preferable to household dietary diversity indicators, because they provide more specific data that is more directly relevant to most program interventions and policy concerns. The individual measures have been developed more recently, however, and are only beginning to find their audience among program managers and policymakers. It is also very important to note that diet diversity is useful primarily to diagnose undernutrition. Other kinds of data are needed to address overconsumption and risk factors for obesity and diet-related disease.

## **Dietary energy from household surveys (kcal/day, or pct. of requirement)**

A large number of countries conduct household consumption and expenditure surveys (HCES) with regular periodicity. [De Weerd et al. \(2014\)](#) report that nationally-representative HCES data collected since 1990 are available for 129 developing countries. The primary purpose of these surveys is to measure of living standards and poverty rates, taking account of all income sources available to the respondent. Some surveys also ask respondents about specific kinds of income levels, but self-reported income rarely accounts for all the resources used to acquire food and other goods. As discussed below there can be significant heterogeneity across surveys ([Smith, Dupriez and Troubat 2014](#)), but since food expenditures dominate household budgets for the poor, most HCES modules are fairly detailed on the amount of specific food items that are bought, consumed from home-produced stock, or obtained as part of an exchange.

HCES data provide the quantities of each food consumed by the household, just like a national food balance sheet does at the country level, by estimating total production plus purchases minus sales, net transfers or gifts, nonfood uses and estimated losses. Food composition data can then be applied to add up the calories, protein, fats and micronutrients in the household's total food consumption, to make normative assessments of nutrient adequacy based on the demographic composition of the household and the recommended dietary allowances (RDAs) or estimated average requirements (EARs) for people of their age, sex, height and weight or physical activity level. ADePT-FSM ([FAO 2015i](#)) is a freely accessible on-line tool developed by multilateral agencies to facilitate the calculation of households' nutrient adequacy and the prevalence of undernourishment at the national and sub-national levels.

HCES data on each food consumption can provide credible measures of household-level and socioeconomic or regional differences in access to food within a country, but comparisons across countries are limited by differences in the design and implementation of each survey's food module. In contrast to the Demographic and Health Surveys, for example, there has been much relatively little effort to make HCES data internationally comparable, and there can be major differences among national food consumption modules in the types and number of products for which information is requested, particularly regarding food consumed away from home. Systematic differences in survey timing also matter due to the seasonality of food consumption, and the recall period over which consumption is measured can influence how much of each food type is recorded.

One of the few studies to compare different survey types for the same population is [De Weerd et al. \(2014\)](#), who found substantially different estimates of mean per capita

calorie consumption and the prevalence of hunger caused by the food lists and recall periods used for data collection. Differences affect not only the estimated mean calorie consumption, but also influence relative rankings of sub-populations (see also [Gibson et al. 2015](#) and [Beegle et al. 2012](#)), and probably also the diet composition that is recorded. To identify and spread best practices, the FAO, the World Bank and other partners are establishing a “Global Hub for Rural and Agriculture Integrated Surveys” (GRAINS) in order to address issues, among others, in harmonizing across core content of consumption expenditure and agriculture surveys, and to develop methodological and operational guidelines for their conduct. This effort should go some way in addressing comparability across countries ([Keita and Mane 2015](#)).

Within a given country and year, one limitation of existing surveys is the extent to which they capture meals consumed outside the home, and how the nutrient content of processed foods is assessed. Based on Indian surveys, [Tandon and Landes \(2011\)](#) find that relatively small changes to assumptions about these can result in relatively large changes in the numbers of those who are food insecure. As consumption habits change over time to include more meals consumed outside the home, and an increase in purchase of processed foods, unchanged survey designs can lead to figures that systematically overstate the prevalence of undernourishment. Another set of methodological challenges is the availability of nutrient conversion factors to convert consumed food items into their nutrient equivalents. Such food composition tables are costly to develop and are rarely updated or locally-adapted to accurately describe the nutrient composition of each population's food supply.

Regarding the uses of HCES data, a major constraint is the long time lag from collection to dissemination of results, caused in part by the need to clean and analyze individual responses collected over a large area. Delays can also be caused by the political importance of the poverty rates and living standards revealed by HCES data, which can have major implications for national governments. Survey data are often released more than a year after they are collected, so the resulting household-level indicators are most useful for longer term policy analysis, targeting programs and diagnosing the causes of food insecurity and malnutrition, rather than guiding short-term responses to recent events. Over time, the harmonization of HCES systems could both facilitate cross-country comparisons and accelerate data dissemination, making household-level data almost as accessible as country-level estimates from national food balance sheets. In the meantime, the relationship between energy intake and undernourishment as measured through HCES and FBS data has been explored by [Grunberger \(2014\)](#), revealing how each scale of analysis provides complementary information, much like the relationship between the FBS and individual dietary intake data explored by [Del Gobbo et al. \(2015\)](#).



## **Diet quality indexes (ratios, indexes or qty/day of a food or nutrient)**

Poor diet quality is not only implicated in adverse outcomes associated with undernutrition but also with those associated with overconsumption. It is now well recognized that diet-related chronic diseases are no longer merely a phenomenon of richer countries but are more widespread, often involving excesses as well as deficiencies of various nutrients during vulnerable periods of child growth and adult development. The result is often a double burden of stunting with obesity coexisting in the same household and even the same individual (e.g. [Shrimpton and Rokx 2012](#)), as malnutrition persists despite energy adequacy.

Indicators of diet quality must be designed to capture the variation in dietary intake observed among particular populations, facing specific risk factors. The simplest would be the share of dietary energy from foods other than starchy staples, but more complex measures include the Healthy Eating Index and Alternative Healthy Eating Index developed for the United States ([HEI 2013](#), [Chiuve et al. 2012](#)) the Mediterranean Diet Serving Score ([Monteagudo et al. 2015](#)), and various scores based on Dietary Approaches to Stop Hypertension (DASH) dietary patterns ([Liese et al. 2015](#)). These have occasionally been compared to each other ([Schwingshackl and Hoffmann 2015](#)), but it is not yet possible to identify a single diet-quality index that would be applicable to all populations.

A major obstacle to measuring diet quality is the very different kinds of health factors as well as culinary practices and effect modifiers that must be taken into account. One effort to produce global measures makes separate scores for healthy and unhealthy foods ([Imamura et al. 2015](#)), applying one set of weights to each beneficial food or nutrient for which intake is usually insufficient, and then a separate scoring for each harmful food or nutrient that is often excessively consumed. Composite measures such as the Diet Quality Index-International combine diversity, adequacy, moderation and overall balance ([Kim et al. 2003](#)), but the weights developed for one setting may not be useful elsewhere ([Tur et al. 2005](#)).

Another obstacle to measuring diet quality at the household level is differences in nutrient needs relative to actual intake among household members. Most diet quality measures are actually developed with individual-level intake data, typically measured through 24 hour recall questionnaires such as the U.S. National Health and Nutrition Examination Survey ([CDC 2015c](#)). The same weighting of foods and nutrients can be applied at the household or even national level ([Reedy, Krebs-Smith and Bosire 2010](#), [Miller et al. 2015](#)), but doing so suffers from the usual problems of aggregation if all food items are not shared proportionally within the household or other population.

Given the difficulty of reaching agreement on diet quality indicators that measure specific nutrients, many practitioners and researchers fall back on the share of total energy supplied by any food other than starchy staples. As noted for national-level measures above, the share of starchy staples in dietary energy was first identified as an indicator of diet quality by [Bennett \(1941\)](#), and since then virtually every study of dietary patterns anywhere in the world has found that individuals and households seeking improved diet quality typically find it in foods other than starchy staples ([Norton, Alwang and Masters 2014](#)). At the individual level, this Bennett's Law transition from starchy staples to other foods stems from the fact that starchy staples are typically the lowest-cost source of dietary energy, providing relatively "empty calories" with few other nutrients or beneficial components. More nutrient-dense and healthful items include leguminous grains, fruits and vegetables or animal-sourced foods. Each of the many non-staple foods brings different features to the diet, but adding them up to count the share of calories from all non-staple foods provides a rough indicator of diet quality for use across households and over time.

The value of Bennett Law as a measure of diet quality is clear mainly among low-income populations for whom starchy staples often provide 60-75 percent of dietary energy, so that a rise in non-staple intake typically brings much needed increases in a wide range of desirable macro- and micronutrients. Among higher-income populations, when starchy staples' share has fallen to 25-40 percent of total calories, other indicators would be needed based on particularly beneficial or harmful aspects of that population's dietary patterns. The share of starchy staples in the diet is clearly not a complete measure of diet quality, but it can be calculated quickly and easily from household as well as individual or national data, and used to inform a wide range of policy choices and program interventions.

### **Nutrient adequacy (pct. of requirements for specific nutrients)**

Micronutrient deficiencies in diets are widespread and have long-term consequences, and are implicated in a wide range of health outcomes, including stunting, cognitive abilities and non-communicable diseases. Yet, unlike insufficient energy intakes, which translate quickly into sensations of weakness and hunger, these deficiencies are not immediately apparent and are therefore often referred to as 'hidden' hunger ([Kennedy, Nantel and Shetty 2003](#)). For the most food insecure households some of the most widespread deficiencies involve inadequate levels of vitamin A, iron and zinc, but many important micro- and macro-nutrients may be insufficiently consumed relative to the needs of particular people at particular times.

The concept of nutrient adequacy begins at the individual level, as each person's mean intake relative to their recommended daily allowance (RDA), estimated average requirement (EAR) or other benchmark for their age, sex, size and level of physical activity. Any inadequacies can then be added up a household or population-level prevalence, defined as the percentage of individuals whose intakes fall below their requirements, or the probability that any given individual will do so. The standard remedy is to consume foods of greater nutrient density, to bring more of the required nutrient per unit of dietary energy. Since nutrient needs and dietary intake typically varies within the household and over time, the accuracy of aggregate or individual measures depends crucially on capturing each individual's intake relative to their needs through frequent and detailed surveys using standardized methods.

The challenge of measuring micronutrient intake relative to needs is similar but even more difficult than measuring energy intake relative to needs. As discussed above, household consumption surveys differ in the length and composition of their food lists and recall periods, leading to differences in recorded nutrient intake – especially for micronutrients like vitamin A that may come from foods consumed occasionally or seasonally, such as liver or mangoes. As noted by [Smith et al. 2014](#), surveys vary widely in their ability to account for this kind of variation, which is typically even greater than the day-to-day variation observed in consumption of staple foods and total energy. The evidence on the extent of measurement error from using household consumption expenditure surveys to estimate micronutrient intakes is relatively limited. One study, conducted in Uganda, compared the gold standard of 24-hour recall with household consumption expenditure surveys; it found that both survey methods yielded comparable estimates of nutrient densities (micronutrient per 2000 calories) of iron, zinc, thiamin, riboflavin and vitamin B6 ([Jariseta et al. 2012](#)); but there were statistically significant differences for vitamin A and other nutrients.

Beyond food recall challenges, the nutrient composition of each food adds another source of error as some surveys may record foods in ways that make it difficult or impossible to find any corresponding food composition data. Even then, those data may not be accurate because nutrient densities can vary depending on how each crop, animal product or food item was made. The density of some nutrients like zinc or iodine depend on their concentration in soils where plants are grown and the ways in which grains are milled; other nutrients like vitamin A are sensitive to methods of cooking, processing and storage. For example, brown rice has nearly double the iron content of white (milled and polished) rice ([Hotz et al. 2012](#)). It is important to use food composition tables that distinguish various types of processing, and also to canvass information on the form in which the foods are consumed or acquired. However, as

mentioned earlier there are limitations to the existing food composition tables, which remain a serious bottleneck in accurately determining the nutrient contents of foods.

Household level consumption may be converted to individual-level units using Adult Male Equivalence (AME) scales; these in turn depend on the household's demographic structure and implicitly assume that the food and nutrients are distributed within the household according to an individual's needs, which in turn are a function of their gender, age and physical activity level. While this may be a reasonable assumption to use when estimating average intakes, there is ample literature to suggest that intrahousehold allocation may not correspond to differences in nutrient needs. In particular, infant and maternal intakes may be below their requirements even as the consumption of other members is adequate, perhaps responding to other factors investigated in the longstanding literature on intrahousehold allocation of food (e.g. [Pitt, Rosenzweig and Hassan 1990](#), [Doss 2013](#)).

In summary, for users concerned with specific demographic groups such as young children or women of childbearing age, household-level consumption and expenditure data may be of limited benefit. This calls for additional investment in individual-level dietary recall data, beyond the HCES data that are collected to measure living standards in general. Specialized dietary recall surveys may also generate data collected more frequently than large, nationally-representative HCES programs, and the results may be released more quickly. Some observers do use country-level food balance sheets to track supplies of micronutrients (for example, [Gibson and Cavalli-Sforza 2012](#)), but these may undercount the most nutrient-rich foods such as vegetables from household gardens, backyard chickens, or informally produced fruits. Greater investment in the collection and dissemination of individual data in dietary intake relative to nutrient needs is a high priority for both policy analysis and program management.

## Experience-based scales

Experience-based measures are based on the premise that self-reported experiences of hunger or changes in behavior that are reported as a consequence of economic stress are valid indicators of food security in themselves, with commonalities across cultures in key dimensions by which food insecurity is experienced. Survey questions about household or individual experiences can be useful even if one has access to more costly and difficult to collect kinds of data, such as diet diversity scores and nutrient intake ([Becquey et al. 2010](#)), as valuable complements to other information ([Cafiero et al. 2014](#)).

In this section we review the three major types of experience scales: the Household Hunger Scale (HHS) and Household Food Insecurity Access Scale (HFIAS), both of which use a 30-day recall period to characterize the experiences of a household as a whole, and the individual-level Food Insecurity Experience Scale (FIES) used to describe the experiences of an individual adult over the previous 12 months. Here we focus on the FIES ([FAO 2015e](#)), since it is among the indicators that FAO's annual report, the State of Food Insecurity (SOFI) and is planned to be one of the SDG indicators.

The FIES is an outcome of the Voices of the Hungry project ([FAO 2015c](#)). It is built up from a series of yes-no responses to a relatively short series of questions, and then converted into a FIES scale using item response theory. In developing this measure, considerable attention was paid to the design of each question, to ensure that the set of all questions spans the kinds of experiences that characterize food insecurity in a wide range of local contexts and cultures, and can then be distilled to a single measure that is internationally comparable.

An important advantage of the FIES is its focus on an individual's own experiences. It is therefore in principle able to distinguish if there is, for example, a gendered dimension to the experience of food insecurity within households, in addition to differences between households, regions and time periods. Another important advantage is that the questionnaire is easy to administer and analyze, so survey costs are low and data can be made available quickly for policy analysis and program management. Finally, there is shared value in monitoring peoples' experience of food insecurity as such, separately from their nutritional status. The experiences measured by the FIES are universally seen to be undesirable, and protecting people from those experiences is a widely endorsed policy objective in both rich and poor countries.

There are however some areas of concern. First, while the questionnaire itself is easy to administer, the definition of the scale using item response theory involves fairly sophisticated statistical theory. Efforts to simplify and clarify how the score is constructed will help facilitate communication about the index outside the community of experts in international organizations, research institutions and a few country statistical offices. A major concern in that translation involves the scaling necessary for cross-country comparisons, and the implications of normalization both internationally and inter-temporally. Finally, as with many diagnostic tools, different causal pathways and coping strategies can lead to the same FIES score, so additional information will be necessary to design appropriate interventions for each place and time.

Apart from these methodological issues, there are also concerns regarding the data collection itself. Currently, Gallup has been commissioned to produce these estimates

for nearly 150 countries; these polls are conducted annually. There are two issues related to the use of the Gallup machinery: the first is that it has implications for country ownership of the data collection needed for the FIES. Second, the Gallup sample sizes are relatively small, at about 1000 per country (3000 for India and 5000 for China), which may be sufficient for cross-country comparisons, but are likely insufficient and underpowered to make comparisons across rural and urban regions, sub-nationally, or even by gender.

In summary, users of the FIES are likely to find that it provides valuable data at low cost, over a wide range of circumstances. Since FIES modules can readily be integrated into other data collection efforts, this index could become widely used for targeted monitoring of at-risk populations and measuring the impacts of specific programs and policies, in addition to the annual country-level data that the Gallup polls are intended to generate.

## **Coping Strategies Index (CSI)**

The Coping Strategies Index (CSI) was developed by WFP and CARE International in 2003, primarily for use in early warning of humanitarian emergencies, with a reduced form (rCSI) in current use as part of the WFP's ongoing vulnerability analysis and mapping efforts (WFP 2016). The CSI and rCSI enumerate both the frequency and severity of coping strategies of households faced with short-term insufficiency of food. The index is based on the many possible answers to a single question, namely "what do you do when you do not have enough food and don't have the money to buy?" The list of possible answers in each survey is determined by focus group discussions in the local community before CSI surveys are implemented. Monitoring fluctuations in the index can give a rapid indication of whether food security is improving or deteriorating.

Through CSI surveys considerable data on coping strategies has been collected over the years. These data could now be used in conjunction with other evidence to improve early warning indicators and surveillance systems. There is also a need to develop coherent response strategies for the coping mechanisms identified, some of which are harmful, whilst others can better inform the implementation of national social protection strategies.

## **Anthropometric measures**

Anthropometry is the measurement of a human body's physical dimensions, principally in terms of height, weight and circumferences. The resulting measures are used for many specific objectives involving the nutritional status of individuals and populations. Anthropometric measures are most useful when compared to their distribution in a healthy population, and to cutoff levels associated with elevated risk of adverse outcomes. Measures of height are usually used only to assess population status, but weights are widely used to detect and treat individuals affected by either undernutrition or obesity, and waist or head circumferences may provide additional information about nutritional status and health.

Anthropometric measures offer a historical perspective on physical development, capturing accumulated changes in body size caused by dietary intake, physical activity, infection and other factors. The values derived from anthropometric measurement do not tell much about the causal factors involved, but some clues are provided by the specific component of the human body affected. Heights reflect linear growth of the skeleton, while weights reflect accumulation of both muscle and fat. Linear growth faltering is most often observed in infancy and early childhood, while muscle and fat can be accumulated or lost at any time.

Indicators based on anthropometric measures typically compare an individual's weight, height, or circumferences to a reference population of their age and sex. The standard measures for children involve weight-for-age and height-for-age, or their weight-for-height ratio at each age. Weights are roughly proportional to volume which rises exponentially with height, so for older children and adults a commonly used indicator is the body mass index (BMI) defined as weight per height squared. More direct measures of circumferences around the head, arms, waist and hips can also be useful to detect undernutrition or obesity, as described below.

Anthropometric indicators provide information on the outcome of a number of factors influencing utilization of food in the body. These include gross food intake and diseases. However, a value that is obtained when anthropometric measurements are done does not provide information about specific drivers or causes of the outcome, unless the anthropometric data is combined with additional data, for example dietary recall or food frequency. Anthropometric values are most useful as population statistics, such as means or prevalence rates. Even under ideal conditions, individuals may vary widely in size due to differences in genetics and life experience, but differences at the population level provide clear signals of health disparities.



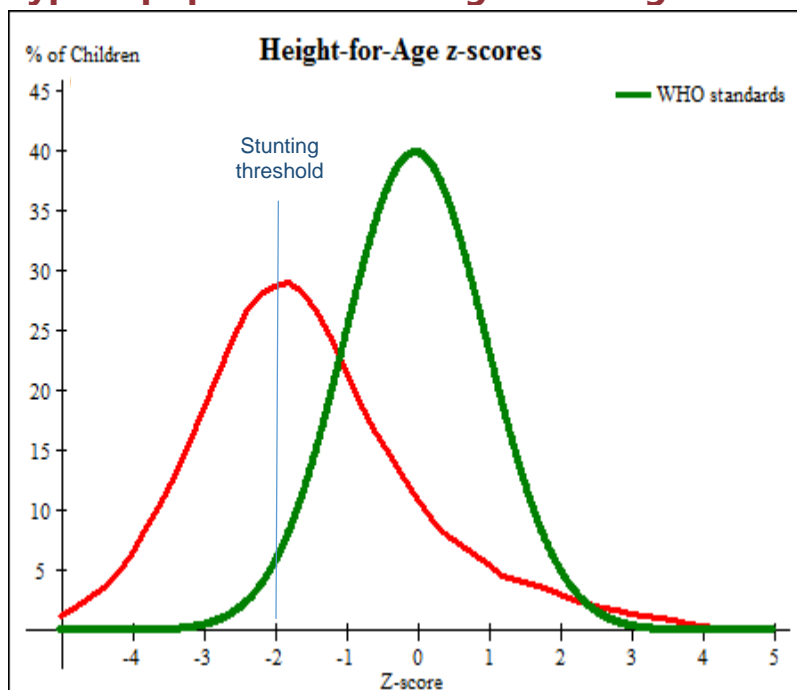
Anthropometric indices are computed after data collection in fieldwork and may not be useful in providing immediate counseling at the time of data collection. In addition, Demographic and Health Survey ([DHS 2015](#)) data are collected once after a long period, usually five years, and they focus specifically on maternal and child anthropometry. Countries should strive to have more routine data collection, and also seek broader coverage of older children and adults. More importantly though, anthropometric data should be collected at the community level accompanied by efforts to empower users on how to use these data/values for not only policies and programmes but also for immediate counseling of affected individuals.

Some of the limitations of anthropometric data include the lack of specificity assessing nutritional status, as changes in body measurements are sensitive to many factors including intake of essential nutrients and infections. In some countries, the age of children is difficult to determine. It is also difficult to measure the length (i.e. height) of young children, particularly infants, with accuracy and precision. Accurate anthropometric measurement requires training and adequate measurement equipment, both of which can be lacking in low-income settings.

## Child height-for-age (prevalence of stunting, or mean height)

Children's heights provide a clear summary measure of population-level nutrition and health status. A well-nourished population has a distribution of heights similar to the WHO standards shown in the chart. The most extreme deprivation results in stunting, defined as having a height (or length)-for-age more than two standard deviations below the median observed among well-nourished children of that age and sex ([WHO 2006](#)). Units of standard deviation are Z scores. The threshold for stunting is a Height-for-Age Z (HAZ) below -2. In a well-nourished population, only 2.25 percent of children will be below that threshold. In a malnourished population as shown in the figure, the fraction of children stunted can rise above 50 percent. Even children who are not stunted may have experienced some deprivation relative to their growth potential, so users may also want to consider the mean height not HAZ of all children in the population of interest, disaggregated by age group.

**Figure 12. Distribution of child heights in a typical population with high stunting**



Source: Authors' illustration

The reduction or elimination of stunting is major policy and program priority, as one of six WHA targets and a principal indicator for the SDGs (it was also one of the indicators for the MDGs). Nationally representative surveys are currently available for over 100 countries ([GNR 2015](#)) but are not collected often enough for this goal to be monitored and enforced on an annual basis. Increasing coverage and frequency should be a high priority, requiring targeted investment in building national capacity for anthropometric surveys, measurement and reporting.

Stunting is particularly valuable as an indicator of chronic food and nutrition insecurity accumulated during the periods of child development when linear growth is normally expressed. Growth faltering below a child's growth potential is most often observed to occur in infancy, typically between 2-3 months and 2 years of age, but linear growth faltering may begin in utero and also occur at later stages of child development and

adolescence. Children who experience growth faltering typically do not recover their full potential height, either because of continued chronic exposure to inadequate intake and disease episodes, or because they lack any mechanism to drive catch-up growth. A child's linear growth is closely related to episodes of weight loss or gain, which becomes increasingly important as a measure of nutritional status for older children and adults whose heights are predetermined.

Most policies and programs currently focus on stunting among all children below five years of age. Variation in stunting rates is most pronounced among the youngest of those children, so with increased frequency and coverage of anthropometric surveys it will be possible to focus on the under-two stunting rate (not only under-five), which would provide greater sensitivity to recent changes in nutrition and health. More generally, it would be useful to disaggregate the data by age so that measures can be taken and causes identified at an early stage. Furthermore, focusing on the prevalence of stunting ignores the information already collected in each survey about the heights of children who are below or above the threshold z score of -2. Tracking the mean height of a population counts all people equally, and can then be disaggregated to consider the mean height of specific subpopulations of interest such as those most at risk of food insecurity and malnutrition.

While population heights are widely recognized as the best overall indicator of malnutrition over the life course, there are reasons to be concerned about the quality of height data as it takes training, adequate tools, and motivation to successfully measure length/height, as well as accurate age records. Relatively little investment has been made in data accuracy, despite the importance and global interest in stunting as an indicator of human development. Errors in measurement provide an additional rationale for focusing on mean heights rather than stunting prevalence, because a survey with more variance will overstate the share of people with extreme values (including especially those below the stunting threshold of  $HAZ < -2$ ) with much less effect on that population's mean. Reporting mean HAZ scores would not cost anything extra and provides a more scientifically valid statistic for measuring accumulated deficits in child growth. However this should be seen as a complement, rather than a substitute, for stunting rates because from an advocacy perspective stunting is more politically salient.

The sensitivity of stunting rates to changes in child nutrition depends crucially on the age range over which results are reported. Since most of the variation in stunting between populations appears in the first two years of growth, comparing rates for children under-two would provide more sensitive measures than the averages for all children under-five that are typically reported. The value of this increased sensitivity

depends on having enough observations of children in the 6-23 month range when stunting is most responsive to intervention, and having their lengths and ages measured precisely which is difficult to accomplish due to the small absolute differences involved.

For policy analysis and program management, a major question regarding child heights is how quickly improvements can occur when nutrition improves. Recent research from Maharashtra, India carried out by IFPRI with UNICEF data ([Haddad et al. 2014](#)) showed that under some conditions even small mothers can have well-nourished children. Realistic expectations about the speed of change in stunting rates associated with any one intervention is key to successful use of this indicator, however, and even if many things go well simultaneously (including a sharp fall in poverty rates as in Maharashtra) it may take 15 or 20 years for child stunting rates to reach the WHO reference levels of around two percent.

### **Child weight-for-height and MUAC (prevalence of wasting or thinness)**

Wasting, also referred to as thinness, refers to low weight for height and is expressed as low weight-for-height (WHZ) compared to the WHO international growth reference or mid-upper arm circumference (MUAC). Wasting indicates a deficit of tissue and fat mass compared to the amount expected in a child of the same height or length. It may result from failure to gain weight or from rapid weight loss. Wasting is used as an indicator of acute food (shortage) insecurity and it reflects recent starvation, persistent diarrhea, or both. The degree of acute malnutrition is classified as moderate (MAM) or severe (SAM). Children 0 - 59 months and school children who are below -2 standard deviations (moderate and severe) from median weight-for-height of the WHO Child Growth Standards or international growth reference (total number and percent) or reference population. Derivation of this indicator requires measurement of weight and height and requires additional computations, which may take some time to obtain the result.

This indicator belongs to a set of indicators whose purpose is to measure nutritional imbalance and malnutrition, resulting in undernutrition (underweight, stunting and wasting) and overweight. Child growth is the most widely used indicator of nutritional status in a community and is internationally recognized as an important public health indicator for monitoring health in populations. In addition, children who suffer from growth retardation as a result of poor diets and/or recurrent infections tend to have a greater risk of suffering illness and death.

MUAC is a measure of the diameter of the upper arm, and gauges both fat reserves and muscle mass ([SCN 2000](#)). MUAC is useful in situations where data on height, weight, and

age are difficult to collect. This measure is quick, easy, and does not require special equipment, references for interpretation or highly trained anthropometry specialists. It is instant and does not require additional computation. The results can immediately be communicated to the affected individuals for action. However, MUAC measurements are not routinely done and it is not part of the DHS data. Measurement of MUAC is frequently done during an emergency situation to identify individuals with acute and severe food insecurity. It is now being used at community level to identify children with severe food insecurity.

Beyond MUAC, another circumference indicator of potential interest to some users concerns a child's cranial development. Head circumference can be measured as readily as MUAC, and provides a complementary measure of child development associated with food insecurity, dietary intake and health ([Miller et al. 2016](#)). Head circumferences are not now widely collected in anthropometric surveys, but could be introduced in future data collection efforts.

### **Child underweight: weight-for-age (number or pct. of children)**

Underweight refers to low weight-for-age, which can occur when a child is either thin or short for their age. As with other child development indicators, the customary cutoff for identifying individuals at high risk is being more than two standard deviations below the median of the WHO's reference population of healthy children. Severe underweight, defined as being more than three standard deviations below the WHO median, is used as an indicator of acute food insecurity and it reflects recent starvation, persistent diarrhea, or both. Underweight is the most common indicator collected in growth monitoring systems in many developing countries.

Weight-for-age reflects body mass relative to age. It is a composite measure of muscle, fat and skeletal mass. Unlike height, weight fluctuates over time and may reflect current, acute and chronic food insecurity. However, it is not one of the WHA targets despite its powerful indication of immediate food insecurity, especially among children below five years of age. Data on underweight are collected often to be able to monitor changes overtime. Of the indicators reviewed in this User's Guide, this is the only indicator for which data is collected routinely in health clinics in many developing countries. However, this indicator has not been linked to child development e.g. cognitive and intellectual to the extent the indicator for stunting has been used.

As with stunting and wasting discussed above, the data in the DHS and UNICEF databases are presented as an average for all children below five years of age, therefore

there is no age specific disaggregation to identify age groups that may be more affected. It could be useful to disaggregate the data by age to identify the critical age at which food and nutrition insecurity is a big challenge. In addition data on school children (6 - 18 years, both boys and girls) is limited. The weight and age data could be collected in schools and compiled at a national level to provide information about the nutritional status of school children. Measurement of weight does not require elaborate equipment and personnel training to do the measurement and thus the level of error is also not as high as compared to that of height measurements.

There is more use that could be made of this indicator than is currently done. This is a potential early warning indicator and allows for some intervention. Weight-for-age monitors the individual child growth regularly and provides a unique opportunity to counsel the caregiver and provide information to correct any growth faltering. For example in the 1980's there was a community based growth monitoring and growth promotion models that empowered communities to discuss findings and find local solutions to any growth faltering. However there has been significant reduction in investments into these important programmes in terms of scales, child health cards, and training. The Child Survival, Protection and Development (CSPD) programme followed the integrated nutrition approach and was community-based so that community participation and empowerment were strongly emphasized. Community members were able to provide input into the monitoring of child growth and follow up by leaders of children who had shown signs of growth faltering ([SCN 1993](#)).

### **Adult, adolescent and child BMI (prevalence of underweight, overweight or obesity)**

Once an individual's height trajectory is determined, changes in food security and nutritional status are reflected in their accumulated weight. Weight changes primarily reflect imbalances between intake and expenditure of dietary energy, potentially triggered by many factors including physical activity, diet quality and illness that cause deposition or loss of muscle, fat and other tissues. Changes in water retention may also be important, especially for short-run fluctuations. It is possible to measure body composition and thereby distinguish among types of body tissue but doing so requires clinical methods and costly biomarkers ([Fosbol and Zerahn 2014](#)). Almost all practical anthropometric measurement therefore focuses on total body weight, or the circumferences described elsewhere in this document.

Given the nonlinear relationship between height and normal body weight, the principal indicator of weight for adolescents and adults is the body mass index (BMI), defined as a

person's weight in kilograms divided by the square of the person's height in meters ( $\text{kg/m}^2$ ). BMI is very widely used as an indicator of either thinness or obesity. Both extremes of body weight are linked to food security and many other aspects of health and human development. It should be noted, however, that BMI can be misleading since it does not account for the relative proportions of muscle and fat or bone mass, water retention and other variations in body composition. For example, more muscular people may be classified as overweight or obese. Similarly, taller people have more bone mass relative to either muscle or fat so could be misclassified as underweight, and shorter people could be misclassified as overweight. Despite these issues, the simple BMI metric has proven to be remarkably useful since its introduction by Alphonse Quetelet in 1832 ([Eknoyan 2008](#)), reflecting commonalities in scaling of normal weights and heights across human populations ([Heymsfield et al. 2014](#)).

In general, the range of BMI values associated with lowest health risks is 20–25. BMI values above 25 are considered overweight, and above 30 indicate obesity. BMI scores below 18.5 are classified as underweight, which is particularly important for adolescent girls and women in respect to the physiological demands of pregnancy and breastfeeding. Although maternal underweight remains a widespread concern, the most rapidly increasing threat to global health is obesity, whose worldwide prevalence more than doubled since 1980 ([WHO 2015d](#)). Excess weight is typically accumulated gradually and is difficult to reverse; in many settings the onset of excess weight gain is occurring at younger and younger ages, and is associated with higher risk of diet-related chronic illnesses such as diabetes and cardiovascular diseases, calling for prevention of excess weight gain throughout the life course ([Llewellyn et al. 2015](#)).

For children and adolescents, BMI is usually converted to percentiles or z scores relative to the WHO reference population, to account for differences in body composition by age and sex. With percentiles, overweight is defined as a BMI-for-age level at or above the 85th percentile, while the cutoff for obesity is the 95th percentile, and underweight is defined as a BMI-for-age level below the 5th percentile ([CDC 2015b](#)). Z scores are defined in terms of standard deviations, with BMI-for-age z scores used in the same way as weight-for-height z scores. Since these require only the child's height, weight, age and sex, a BMI calculator or card can be helpful for immediate counseling and action. If this calculator could be put on phones, along with accessibility to measurement equipment, then it will be possible for each individual to know their BMI and share that information with counselors. It would also be possible to establish a database, which would allow aggregation of data from lower levels to the global level. However, the issue of data quality would remain a challenge due to limited skills and inadequate equipment for data collection.



The World Health Assembly (WHA) target is to have a zero percent increase in childhood overweight, but this indicator is not collected on a routine basis. There are very few nationally-representative surveys of school-age children and adolescents, so assessments remain based primarily on smaller community-level surveys and nationally-representative data for children under five and their mothers. Accelerating the spread of anthropometric measurement is a high priority not only to track progress against undernutrition, but also to monitor and prevent the rise of obesity and diet-related chronic disease.

### **Waist circumference (pct. of population above risk thresholds)**

The health consequences of weight gain are particularly clear in the case of abdominal adiposity and central fat deposition relative to skeletal size. Clinical researchers can use biomarkers to measure fat directly, but this is impossible to do in field surveys. More readily measured indicators of obesity are those related to circumferences at various sites of the body. These measurements alone or in combination, as in waist/hip circumference ratio, which includes a measure of waist and hip circumference, provide information about accumulation and distribution of fat in the body. The location of accumulated fat in the body has significant influence on metabolic conditions of the body, so circumferences may provide a more accurate predictor than BMI of cardiovascular risk, type 2 diabetes, and metabolic syndrome.

Measurement of waist circumference is easy, uses a very basic tape measure and does not require elaborate training. However, there are issues related to placement, tightness and type of measuring tape. Currently, there are tape measures that are marked with green, yellow, and red to provide a clear interpretation of the measurement. Using this kind of tape measure for waist circumference provides the user with an instant result and interpretation of the measurement. The waist-to-hip ratio, known as W/H or WHR, is the ratio of the circumference of the waist to that of the hips. This is calculated as waist measurement divided by hip measurement. The [WHO \(2011\)](#) cutoffs identify substantially increased risk of metabolic complications with a waist-hip ratio above 0.90 for males and above 0.85 for females.

## Prevalence and depth of undernourishment

A combination of individual data on age, sex and height, with household data from food consumption and expenditure surveys, plus country-level data from food balance sheets is used to produce the UN system's headline measure of dietary deprivation, known as the Prevalence of Undernourishment (PoU). This indicator is calculated annually by the FAO for all countries of the world, using year-to-year changes in food balance sheet data combined with less frequently updated HCES and demographic information. As explained below, PoU data are primarily used directly to calculate the percentage or number of people who are undernourished, but it is also used to compute the depth of that undernourishment relative to each population's estimated requirements.

### Prevalence of Undernourishment (pct. of pop., or millions of people)

The PoU is defined as the number or fraction of people whose dietary energy intake is below the threshold Minimum Dietary Energy Requirement (MDER) for their age, sex and height. The MDER for each age-sex category is lower than the Average Dietary Energy Requirement (ADER) described earlier because it is based on estimated energy requirements for light physical activity and minimum acceptable body mass index (BMI), whereas the ADER assumes more physical activity and larger body mass. The PoU is among the world's most widely cited indicators of food insecurity and hunger, computed annually for all countries in the world and used for international agreements such as the UN's Millennium Development Goals and Sustainable Development Goals.

The most direct way to compute an undernourishment indicator would be to count the individuals whose measured dietary intake is less than their estimated energy requirements. Individual intake is expensive and difficult to measure, however, and energy requirements are also challenging to estimate due to variation in lifestyle, work intensity, body metabolism and disease that are not easily observable ([Naiken 2014](#)). The MDER used to calculate PoU is based on the proportion of each population at each age and sex, adjusted for differences in height across populations. A weighted average of the sub-population proportions (with weights equal to the proportion of sub-population in the population) yields the proportion of population undernourished (PPU). In notation, this can be compactly expressed as the following. Suppose there are  $n$  age-sex categories with population weights  $w_j$ . Let  $r_j$  be the MDER for the  $j$ th category and  $e_j$  be the energy intake of a randomly selected individual in category  $j$ . Then the  $PPU = \sum_j^n w_j Prob(e_j - r_j \leq 0)$

Direct measurement of individual dietary energy intake by age and sex is not usually possible, so PoU makes use of households' total dietary energy intake from standard household consumption and expenditure surveys. The PoU then marries the sub-

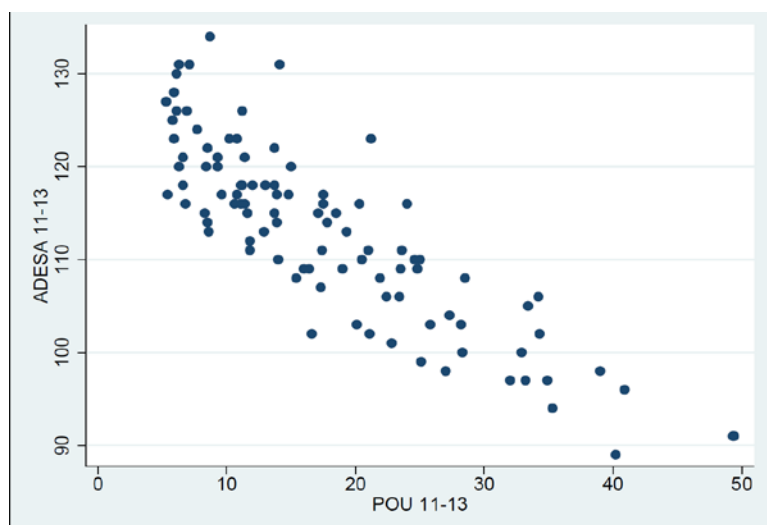
population's MDER with household dietary intake data, through the notion of a representative individual defined as the population weighted average of each age-sex category. The dietary intake and the MDER of this average individual is the population weighted average over all age-sex categories, and the PoU is the probability that the representative individual is undernourished ([Cafeiro, 2014](#)). Using the above notation,  $PoU = Prob(\sum_j^n w_j e_j - \sum_j^n w_j r_j \leq 0) = Prob(\sum_j^n w_j (e_j - r_j) \leq 0)$

In general, the PoU is not equal to the PPU. Its major limitation is that the PoU cannot be disaggregated by gender and age. The estimation of PoU requires (a) estimates of the average MDER of the population and (b) the probability distribution of dietary energy intake of the representative individual. For (a), the FAO employs normative energy requirements standards from a joint FAO/WHO/United Nations University expert consultation, based on requirements associated with a sedentary lifestyle. For (b), the FAO estimates the mean of the distribution from food balance sheet data, The variance and higher moments are estimated from household survey data ([Wanner et al. 2014](#)).

The PoU has been criticized for using the MDER which posits an energy requirement that is "too low" for some purposes, thereby understating the extent of undernourishment. Such users may prefer the average dietary energy supply adequacy (ADESA) that uses average, rather than minimum, dietary energy requirements. In practice, however, PoU and ADESA are strongly correlated. The graph shown here in Figure 13 plots the country indicators for both of them for the period 2011-13. The correlation between the two indicators is -0.86. Similar results were obtained from earlier years. Whenever PoU is low, ADESA is high and vice-versa, revealing that the principal influence on these indicators is the population's average calorie intake estimated from the FBS.

The PoU has also been criticized for its reliance of food balance sheet data, given the inevitable errors in its underlying components of production, trade and wastage, but the available household consumption survey or individual dietary assessment data are also subject to considerable error ([De Weerd](#)

**Figure 13. Dietary energy supply and prevalence of undernourishment (PoU), 2011-13**



Source: Our computations, from FAOSTAT data.

[et al. 2014](#)) calling for careful attention to how household data would be used ([Smith and Subandoro 2007](#)). In particular, dietary recall suffers from well-known undercounting of energy intake. For this reason, the PoU uses FBS data for the mean, and survey data (when available) for variance and skewness of the distribution. One of the strongest limitations on PoU measurement is that survey data are not available for many countries in many years, so that variance and skewness must be extrapolated. FBS data can also be noisy, so that PoU estimates are made with moving averages and smoothing techniques that limit its sensitivity during periods of high volatility such as the 2007-2010 food crisis.

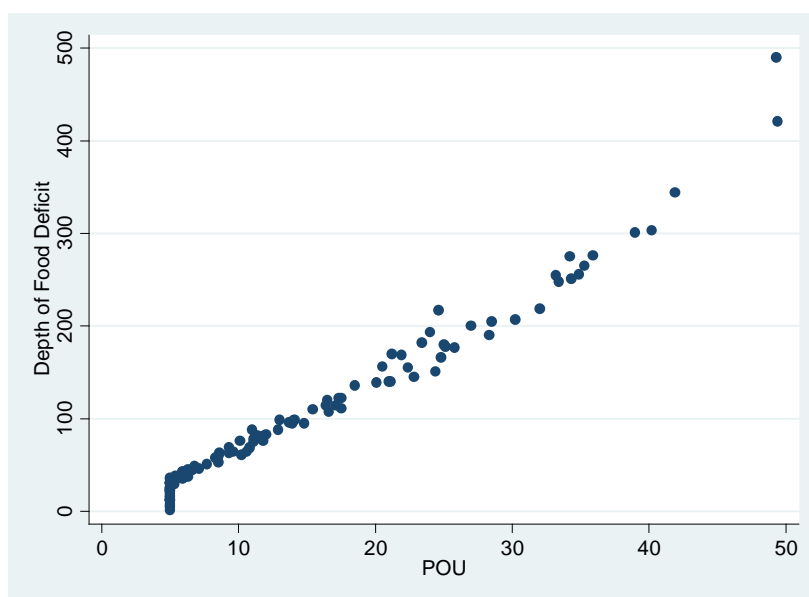
Finally, when using PoU estimates, it is important to note that it defines “undernourishment” in terms of dietary energy alone. Malnutrition and ill-health involve more than just calories, and the underlying cause of low energy intake remains unknown. For this reason, the PoU is best seen as a diagnostic tool, calling for further investigation into the determinants of low intake. The remedy may include increases in households’ access and use of basic staples, but may also include control of infection, micronutrient deficiencies, and other causes of malnutrition.

## Depth of food deficit (kcal/capita/day)

The depth of food deficit is the difference between the estimated dietary energy intake of the undernourished population and their average dietary energy requirement (ADER). The difference is multiplied by the number of undernourished to obtain the total calorie deficit, and may be divided by the country's total population to give a per-capita measure. The indicator provides an estimate of the total calories that would be needed if each of the undernourished were to attain energy intakes equal to the average dietary energy requirement. Like PoU, the indicator is based on FBS data for the population's mean intake, combined with household surveys for variance and skewness, demographic data for the number of people in each age and sex category, and their average height. The main difference is that it is based on ADER rather than MDER.

The uses of this depth indicator are similar to those of a poverty gap index. The poverty gap is the amount of money needed to raise each poor person to the poverty line. Similarly, the depth of food deficit is the total amount of additional food, in calories, that would be consumed if each undernourished person reached their ADER. In principle, the depth of food deficit offers information not captured by PoU. In the data shown here for 2011-13, however, both are highly correlated. The correlation coefficient for this particular period is 0.98.

**Figure 14. Depth of food deficit and prevalence of undernourishment (PoU), 2011-13**



Source: Our computations, from FAOSTAT data.

## **Biomarkers and clinical data**

This category of indicators is used for data that require bodily samples (biomarkers) or records collected from health service provision (clinical data). A vast array of indicators based on biomarkers and clinical data could potentially be collected, and as elsewhere in this document we focus only on those indicators which are most widely used for policy analysis and program management.

### **Anemia among women and children (percent of population)**

Anaemia is often used as an indicator for iron deficiency, one of the most common nutrition problems in developing countries. Iron deficiency is associated with developmental delays and behavioural disturbances in children as well as maternal deaths in pregnant women. Anaemia has been shown to be a public health problem that affects low-, middle- and high-income countries and has significant adverse health consequences, as well as adverse impacts on social and economic development. The proportion of all anaemia amenable to iron in 2011 was around 50 percent in women and 42 percent in children ([WHO 2015b](#)). The second global nutrition target of the WHA for 2025 (Box 2) calls for a 50 percent reduction of anaemia in women of reproductive age ([WHO 2015](#)).

Anaemia is the condition of having a lower-than-normal number of red blood cells, or quantity of hemoglobin, or a reduction in the concentration of hemoglobin (Hb) in the blood leading to low capacity of the blood to carry oxygen around the body. The type of anaemia that is associated with iron deficiency represents the final stage of iron deficiency and occurs when the production of hemoglobin falls below normal values due to insufficient iron. A low hemoglobin concentration or low hematocrit (Hct) level is defined by age and gender specific cut-off values based on the 5th percentile from the US National Health and Nutrition Examination Survey, NHANES ([CDC 2015c](#)).

Children of one to two years of age are considered anaemic if their Hb concentration is less than 11 g/dL or Hct level is less than 33 percent; and for children two to five years of age if the concentration is below 11.1g/dL or their Hct is less than 33 percent; Women of reproductive age (15-49 years), both pregnant and non-pregnant, with hemoglobin levels below 12 g/dL and for women of reproductive age and below 11 g/dL for pregnant women. Hb and Hct values are automatically adjusted for altitude ([WHO 2011a](#)).

Anaemia testing is supposed to be a routine measurement in many hospital or health facility settings, especially in reproductive and child health facilities, but there is a challenge of actually doing the measurement due to limited facilities for conducting the

measurement. Anaemia especially due to iron deficiency is an indication of limited availability and access to iron rich foods but could also be due to high intestinal infestation and blood cell destruction by malaria and other blood parasites. Measurement of anaemia requires actual blood samples and appropriate equipment to measure the hemoglobin concentration. Unless it is done in a health facility, taking blood samples can require approval from research ethics board.

Both the method of hemoglobin measurement and blood sample source (capillary versus venous blood) can affect the measured hemoglobin concentration. The cyanmethemoglobin and the HemoCue® system are the methods generally recommended for use in surveys to determine the population prevalence of anaemia. In the cyanmethemoglobin method, a fixed quantity of blood is diluted with a reagent and hemoglobin concentration is determined after a fixed time interval in an accurate, well calibrated photometer. The cyanmethemoglobin measurement is the reference laboratory method for the quantitative determination of hemoglobin and is used for comparison and standardization of other methods. The HemoCue® system is based on the cyanmethemoglobin method and has been shown to be stable and durable in field settings. The source of the blood sample should also be considered when assessing hemoglobin concentrations. Some studies suggest that hemoglobin values measured in capillary samples are higher than those measured in venous samples, potentially leading to false-positive results. Although the most reliable indicator of anaemia at the population level is blood hemoglobin concentration, measurements of this concentration alone do not determine the cause of anaemia. Anaemia may result from a number of causes, with the most significant contributor being iron deficiency. In this regard there are other measures that can be done, including ferritin and transferrin tests.

Ferritin is the major iron storage protein of the body. Ferritin contains 20 percent iron. The greatest concentrations of ferritin are typically in the cells of the liver (known as hepatocytes) and immune system (known as reticuloendothelial cells). Ferritin is stored in the body cells until when it is needed to make more red blood cells. Therefore ferritin levels can be used to indirectly measure the iron levels in the body. Similarly, transferrin is a protein that combines with ferritin to transport iron to where new red blood cells are synthesised. Transferrin picks up iron absorbed by the intestines and transports it from one location to another. The standard cutoffs are transferrin saturations of less than 16% to indicate iron deficiency, and transferrin saturations of more than 45% to indicate iron overload ([EASL 2000](#); [CDC 2002](#)).

Ferritin is typically assessed in serum or plasma with enzyme-linked immunosorbent assays (ELISA) or enzyme immunoassays after venous blood collection; however dried



serum spot samples can also be used to facilitate field collection. In areas of widespread infection or inflammation, defining iron deficiency using serum ferritin is a challenge. Therefore in such areas if infectious diseases are seasonal, then data collection should be done in the season of lowest transmission. However, if infections are permanent, then the concurrent measurement of two acute phase response proteins (C-reactive protein (CRP) and  $\alpha$ 1- acid-glycoprotein (AGP)) can be combined in the interpretation of serum ferritin values. Use of these high technology methods leaves very minimum chances of using these indicators in a routine basis in economically poor settings. Therefore the HemoCue® will remain a method of choice despite the limitations. The HemoCue® method provides an instant result, the value is often used to counsel affected individuals accordingly and immediately. Hemoglobin value is also a population statistic and can be used to compare localities, socio-economic status and ages as well as sex. The data for anaemia may be available at health facilities and captured during some surveys (e.g. DHS) but data is not routinely analyzed for counseling. [WHO \(2015b\)](#) has reported data from 257 surveys conducted between 1990 and 2012, from 232 (90%) nationally representative sources, of these 205 sources (80%) had data on women and 224 (87%) had data on children. Data were most sparse in the WHO European Region but all countries in the WHO South-East Asia Region had at least one data source, as was the case for 78% of countries in the African Region.

Anaemia is one of the leading causes of maternal mortality during delivery. This stems from the fact that anaemia is not monitored adequately during the course of pregnancy partly due to poor attendance of pregnant women to the clinics but also due to inadequate supply of equipment and tools as well as limited skills of clinics' personnel for measuring hemoglobin concentration. However it should be kept in mind that the information about anaemia is biased in that there is limited information about it among males. In several spot surveys, it has been shown that anaemia prevalence is higher among men than women contrary to the long held understating that women are more prone to anaemia than men are ([Kinabo et al. 2011](#)). This has a significant implication both in reproductive health and productive capacity of the populations. A population with high prevalence of anaemia among children and adults (both men and women) will not be able to produce and thrive due to inability of the blood to transport oxygen, which is needed for metabolism and energy generation in the body. Prevalence of anaemia is an indication of food insecurity resulting from inadequate intake of iron rich foods. Thus it is important to monitor blood hemoglobin concentration so as to be able to reduce the negative impact of anaemia in the population.

## Low and very low birthweight (percent of births)

Low birth weight (LBW) is defined as a birth weight of an infant of less than 2,500 grams regardless of gestational age; and very low birth weight (VLBW) is less than 1500 grams and that of less than 1000 grams is referred to as extremely low birth weight (ELBW). The WHA target is reduction of LBW by 30% by 2025 ([WHO 2015](#)). The global prevalence of LBW is 15.5 percent, which amounts to about 20 million LBW infants born each year; 96.5 percent of them in developing countries ([WHO 2015c](#)). LBW remains a significant public health problem in many developing countries, and poor nutrition both before and during pregnancy is recognized as an important cause. Low birth weight is an indication of food and nutrition insecurity among pregnant women and can be used as a measure of household food insecurity. LBW is an outcome of foetal growth restriction/retardation (also called small for gestational age and small for date). This means a foetus doesn't gain the weight that should be gained before birth. Low birth weight constitutes a 60 to 80 percent of the infant mortality rate in developing countries. ([WHO 2015c](#)).

Data on birth weights are difficult to capture through a survey unless the household keeps proper delivery records. If a child is born in a health clinic the birth weight is usually recorded at the time of delivery. Based on this data the prevalence of LBW, VLBW & ELBW can be estimated. However a substantial proportion of infants are born outside a health facility (e.g. at home) and therefore their weights are not recorded. In addition, birthweight is not recorded for the majority of newborns in many African countries, since scales and skills to read them are scarce. Furthermore professional health services reach only a minority of the population. Therefore the information conveyed by LBW, VLBW, and ELBW cannot be used for protecting those at highest risk of dying. Other challenges associated with this indicator is the issue of recall of data by mothers or caregivers. If birth was not done at a health facility it is very difficult for the mother to even know and therefore be able to recall what the birth weight of her child was. Nevertheless, this is a very good indicator for assessing food and nutrition insecurity of the mother during pregnancy. Pregnancy outcome depends much on the level of dietary intake of macro and micronutrients by the mother during the last trimester of pregnancy.

## Vitamin A deficiency and supplementation (pct. of pre-school children)

Vitamin A is essential for good vision and cell differentiation. Deficiency results in growth retardation, damage to mucous membrane in various tracts, eye damage—and blindness. Vitamin A deficiency is a common form of micronutrient malnutrition affecting 33.3 percent of preschool-age children and 15.3 percent of pregnant women worldwide ([WHO 2009](#)). Vitamin A deficiency (VAD) is a significant public health problem in over 100 countries ([Micronutrient Initiative 2015](#)), which includes overt signs of deficiency, and 122 countries have subclinical levels of vitamin A depletion with marginal liver reserves. Therefore it is one of the major public health problems in many developing countries. Vitamin A deficiency is measured as the percentage of pre-school age children (6 months-5 years of age and in some other surveys they include children of 12 to 71 months) with signs of vitamin A deficiency by using biochemical indicators and clinical signs.

Vitamin A deficiency occurs when the serum level of retinol (a biomarker for vitamin A) is below 0.70  $\mu\text{mol/l}$  in preschool-age children, with the following severity cut-off points mild:  $\geq 2\%$ - $<10\%$ ; moderate:  $\geq 10\%$ - $20\%$ ; severe:  $\geq 20\%$  ([WHO 2009](#)). Vitamin A deficiency exists due to inadequate consumption of vitamin A and or poor utilisation of the vitamin due to either diseases/infection or infestation. Vitamin A is available in two major forms: retinoids (found in animal foods) and carotenoids (found in dark leafy green vegetables and yellow-orange vegetables, and some fruits).

Indicators for assessing vitamin A status in the body include measurement of concentration of serum retinol and retinol binding protein (RBP) as biochemical markers. In addition, biological, functional and histological indicators are also used to assess vitamin A deficiency. Serum retinol is a biomarker of vitamin A status in the body and is measured by high performance liquid chromatography (HPLC), Fluorescence or Ultra Violet spectrophotometry. The assessment of serum retinol status in the body requires biochemical measurement involving a long process of collecting blood samples in the field, treatment of samples in a centralised laboratory and later detection of serum retinol using HPLC. This process may take several months to complete. However, HPLC is a gold standard technique for determining serum retinol in the body. The cut-off value for definition of deficiency in children is less than 0.35  $\mu\text{mol/L}$  and in women less than 0.70  $\mu\text{mol/L}$ . However, if no infection is present in the population under study, values less than 0.70 and 1.05  $\mu\text{mol/L}$  for children and women, respectively, may be more descriptive of vitamin A deficiency ([Tanumihardjo 2012](#)). However, for many developing countries this technique is expensive because of the initial cost of setting up a laboratory and also running costs to ensure that supplies are available in time to facilitate the analysis. In addition, the procedure requires skilled personnel, who may not

be readily available to perform the analysis in many developing countries. Sometimes countries are required to send samples abroad for analysis and this may be liable to sample damage and delays in getting the results.

Retinol binding protein is another marker that can be used to determine vitamin A status in the body. Retinol binding protein (RBP) is from a family of structurally related proteins that bind retinol and solubilises it. RBP also protects retinol from oxidation to retinoid acid. Accumulation of retinol binding protein in the liver indicates that there is insufficient supply of retinol or vitamin A in the body. RBP exists in plasma or serum bound to retinol and forms a reversible complex with transthyretin (TTR) or pre-albumin. Therefore the complex RBP-Retinol -transthyretin transports retinol to specific receptors of various tissues in the body. The recognition of this complex at the receptor site causes the RBP to release the retinol to the cell. Each RBP molecule transports only a single retinol molecule before it is degraded. RBP enzyme immunoassay is a semiquantitative method for detection and quantification of RBP in serum. The test involves collection of blood samples, dilution with buffer and treatment with an antibody and peroxidase enzyme and incubation for 15 minutes. The mixture is washed and treated with Tetramethylbenzidine (TMB) enzyme substrate, and the readings are obtained immediately using a plate reader. The whole process takes between 35 and 40 minutes after the start of the assay. The results of the assay are used to assess vitamin A status and the extent of VAD in populations. In addition, there is a correlation ( $Y = 0.6216X + 0.3233$  and  $R^2 = 0.82$ ) ([Hix, Levin and Gorstein 2003](#)).

Biological signs of vitamin A deficiency can be detected by trained personnel through examination of the eye. Xerophthalmia, keratinomalacia, and Bitot's spots are clinical signs of vitamin A deficiency and are diagnosed and detected by trained medical personnel. Xerophthalmia is a population indicator and a minimum prevalence of Bitot's spots of 0.5% in preschool-age children is considered a public health problem ([Tanumihardjo 2012](#)). However, data collection associated with clinical signs of vitamin A deficiency require a trained and experienced observer and therefore might not be easily captured during a survey.

Night blindness is a functional indicator of visual impairment due to vitamin A deficiency. It is measured by a technique called Electroretinography which is the measurement of the electrical responses of various cell types in the retina, including the photoreceptors (rods and cones), inner retinal cells (bipolar and amacrine cells), and the ganglion cells. Data of night blindness can be collected through personal reports and some are never captured because people associate it with other causes. A population with a high prevalence of night blindness is considered to be at risk for vitamin A deficiency. This data may not be easily accessible since not many people would report to

a health facility for any conditions associated with impaired vision in the dark. It is also very difficult to explain the condition in a questionnaire to enable the enumerator to capture the information adequately during a field survey.

Histological indicators of vitamin A status are based on examination of the morphology of epithelial cells from the conjunctival surface on a piece of special paper (cellulose acetate paper strips) and observation of the shape and size of the epithelial cells under a light microscope. Changes in the morphology of the epithelial cells of the conjunctival surface often times have been associated with vitamin A deficiency. The process involves sample collection, preparation of staining solution, staining and microscopy. It is not a simple and straight forward technique but it is non-invasive. A normal impression of conjunctival surface consists of a sheet of small epithelial cells and abundance of mucous secreting goblet cells, which produce the mucous part of the tear film. During vitamin A deficiency, the epithelial cells are flattened, enlarged and reduced number of goblet cells. Currently there are no reference standards for the classification of vitamin A deficiency on the basis of impression cytology.

Currently no single indicator can be reliably used to assess the full spectrum of vitamin A deficiency. Therefore different aspects of vitamin A status can be used to assess vitamin A status using clinical, biochemical, functional and histological indicators as explained above. Suitable or appropriate method to use will be determined by context and availability of resources (human and financial). The main challenge has been inadequate resources and qualified personnel and equipment to carry out assessment of vitamin A status using histological, biochemical and biological techniques. However, there have been attempts to assess vitamin A status of the populations using proxy indicators such as dietary intake and supplementation.

Dietary assessment can provide proxy information on vitamin A status of the population (e.g. 24 hour dietary recall specifically targeting vitamin A rich foods). However, the information collected through this technique is qualitative in the sense that it provides an indication as to whether vitamin A rich foods are consumed at all; it will not provide information about the quantities of foods consumed and duration of consumption since it is based on immediate past 24 hours. In addition, this technique does not provide information about dietary history to show the habitual dietary intake. For nutrients that can be stored in the body tissues, it is always useful to assess dietary history to see if there has been any consumption of specific foods or nutrients under consideration.

Vitamin A supplementation coverage rate is the percentage of children aged 6-71 months who have received at least one high dose of vitamin A capsule in any year of measurement. UNICEF defines vitamin A supplementation as the percentage of children

receiving at least one supplement in the previous six months. Therefore annual monitoring of vitamin A supplementation would entail data on the proportion of children receiving two annual doses of vitamin A (effective coverage). UNICEF and the World Bank have defined Vitamin A supplementation to refer to the percentage of children ages 6-59 months old who received **at least** two doses of vitamin A in the immediate previous year ([World Bank 2015](#)). The global burden of vitamin A deficiency is greatest in South Asia and sub-Saharan Africa, where there is high prevalence of vitamin A deficiency and low consumption of foods that are either naturally rich in vitamin A or fortified with it. Assessments of vitamin A deficiency are not done routinely. In this regard vitamin A supplementation through delivery of high-dose of vitamin A supplements remains one of the principal strategies for controlling vitamin A deficiency. However, the criterion used to decide on which countries need universal capsule supplementation is based on the proxy measure of national average of young child mortality rates and it is not based on the incidence of vitamin A depletion or deficiency.

In population-level supplementation programs, capsules are distributed without prior knowledge of individuals' serum vitamin A status, and irrespective of whether clinical signs of xerophthalmia are present, based on the assumption that vitamin A supplementation will reduce child mortality even in populations with no clinical signs of deficiency. Data on coverage levels are based on the number of capsules distributed during the campaigns to provide vitamin A supplements to the intended target population i.e. children below six years of age in one year and not how many children's health has improved. Reporting is restricted to achieving coverage, coverage of 80 per cent is considered to be a measure of success. Thus, there has been a coverage of 146 million children annually, 8 billion capsules distributed between 2000 and 2014. However, there has only been a reduction of 23 to 30 percent in young child mortality. This says a lot about the issue of efficacy. In addition, there has been limited research to confirm effectiveness, or monitoring of risks associated with massive doses of Vitamin A.

There are a number of challenges associated with vitamin A capsule delivery programmes: (i) Handling of the capsules is sometimes a challenge in some poor settings (ii) programmes are heavily donor funded and created dependency and therefore leaves a huge question on sustainability (iii) A lot of efforts are put into mobilising communities to participate, which indicates that buy-in from communities is limited (iv) the supplementation is done without additional education on dietary intake; therefore less emphasis is directed to dietary consumption of vitamin A rich foods; (v) vitamin A capsule delivery can distract attention from other solutions for vitamin A deficiency and malnutrition in general.

## **Breastfeeding and sanitation**

### **Breastfeeding: initiation, exclusivity and continuation (pct. of children)**

Breastfeeding has many benefits for both the mother and infant, and the WHO recommends feeding infants exclusively on breastmilk until children reach six months of age ([WHO 2015a](#)). The appropriate timing and exclusivity of breastfeeding is an important indicator of infant nutritional and food security status ([Victora et al. 2016](#)).

Early initiation of breastfeeding (BF), within one hour after birth, is a measure of successful BF practice and access to colostrum. If it doesn't happen early enough it deprives the baby of the essential nutrients at an early stage and may have implications for breastfeeding performance and nutritional status of the infant and child. This is the only time that we can capture food security issues (availability and access) related to infants and children. Data or information about breastfeeding can be captured at the facility or home by indicating on the maternal delivery card and/or child growth card the extent of breastfeeding that the mother has done or the child has received.

Exclusive breastfeeding (EBF) is defined as an infant's consumption of human milk with no supplementation of any type (including infant formula, cow's milk, juice, sugar water, baby food and anything else, even water. Exclusive breastfeeding is a measure of breast milk availability and access by infants. However it relies on self-reporting so it may not be quality data. In addition the response does not mean that the infant was EBF for the entire six months, but simply EBF for any amount of time during the six months. Data on EBF are usually collected from responses of mothers at the time that a child is introduced to complementary feeding. This data item indicates the age of the child when he or she was first fed something other than breast milk and in a way denotes the level of exclusive breastfeeding.

Continuation of breastfeeding at one year is used as a proxy for the quality of diet of infants. However it is important to capture information about other foods that are consumed by infants to be able to assess adequately the diet of infants up to one year. The information is collected by a 24-hour recall and may not provide sufficient information to assess quantity of breast milk consumed in addition to other foods. Currently, it is collected as part of the assessment of dietary adequacy and diversity.

The WHO Global Data Bank on Infant and Young Child Feeding ([WHO 2015](#)) contains data from national and regional surveys on breastfeeding practices. UNICEF also maintains national data on breastfeeding practices ([UNICEF 2015](#)).



## Diarrhea: Incidence and treatment (percent of children)

Diarrhea is defined as the passage of three or more loose or liquid stools per day (or more frequent passage than is normal for the individual). The incidence measure is calculated as the number of children under-five years in the sample that had diarrhea in the 2 weeks preceding the survey by the total number of children under-five years in the sample multiplied by 100.

Diarrhea is a symptom of an infection in the intestinal tract, which can be caused by a variety of bacterial, viral, and parasitic organisms. Infection is spread through contaminated food or drinking water or from person-to-person as a result of poor hygiene practices. Globally, there are close to 1.7 billion cases of diarrhea diseases every year. It is a leading cause of undernutrition in children below five years of age. Diarrhea is clearly a leading cause of morbidity and mortality, but poses a number of measurement challenges in epidemiology. Firstly the data relies on self-reporting so there is a lot of bias. Other challenges include the logistical burden associated with intensive surveillance to be able to monitor incidences and cases of diarrhea, as well as the variability of diarrhea in space, time and person.

Currently, there are inconsistencies in the definition of an “episode of diarrhea”, including defining when it starts and ends, which has a major impact on reported incidence rates. The use of various definitions of diarrhea and episodes leads to misclassification, which in turn affects the estimates of the disease burden in communities and reduces comparability of the findings from different areas. This indicator has its challenges, which need to be resolved before it can be used to assess food and nutrition security. At the global level, prevalence of diarrhea in children under 5 is included as an intermediate outcome indicator to the WHA targets in the WHO maternal, infant, and young child nutrition core set of indicators ([WHO 2015](#)), to be reported on by all countries using DHS or MICS data, or clinical data for countries with low rates of stunting and wasting (<2.3%) starting in 2016. The list of indicators and data are available at the MICS website ([UNICEF 2015](#)).

UNICEF currently maintains data on diarrhea treatment of children under 5, but they do not have data on prevalence or incidence of diarrhea in children ([UNICEF 2015a](#)). Treatment of dehydration related to diarrhea is based on using ORS/ORT with or without Zinc. These solutions are used to replace the fluids lost during a diarrhea episode and maintenance of electrolyte balance in the body. It has become a common practice to administer ORS/ORT at household level; therefore accessing data on use of these solutions at community or household level may be tricky. The only credible source would be at a health facility. In this regard assessment will be done on Care-seeking for

diarrhea, which is the number of children below 5 years of age with diarrhea in the last 2 weeks for whom advice or treatment was sought from a health facility or provider. Therefore, this indicator will not capture those who do not seek care. Another indicator is diarrhea treatment with oral rehydration salts (ORS) and zinc, which is the number of children below 5 years of age with diarrhea in the last 2 weeks who received ORS and zinc all these are compared to the total number of children below 5 years of age with diarrhea in the last 2 weeks; also diarrhea treatment with oral rehydration therapy (ORT) and continued feeding, which refers to the number of children below 5 years of age with diarrhea in the last 2 weeks who received ORT (ORS packet, pre-packaged ORS fluid, recommended homemade fluid or increased fluids) and continued feeding during the episode of diarrhea compared to total number of children below 5 years of age with diarrhea in the last 2 weeks.

Information on diarrhea treatment can be obtained through a survey with mothers or care providers. However, the information is based on the ability of the mother/care provider to remember the whole episode and the treatment or management used. With the current technology, mothers in diarrhea prone areas could be prompted through a short messaging system to record incidences and managements of diarrhea and transmit the information to a health facility for compilation. However, contribution of diarrhea to food insecurity would require additional measurements of weight and arm circumference to be able to link the two.

### **Drinking water: use of clean water sources (percent of households)**

Access to water and sanitation are considered core socioeconomic and health indicators and key determinants of, inter alia, child survival, maternal and children's health, family well-being and economic productivity. Additionally, the use of drinking-water sources and sanitation facilities is part of the wealth index used by household surveys to divide the population into wealth quintiles. Thirty percent of recurrent illnesses are linked to water and sanitation and 88 percent of diarrheal diseases are attributable to the poor quality of water, lack of sanitation and defective hygiene. Waterborne diseases have a greater impact on poor households as the share of health expenditure is greater when their overall budget is low.

Drinking water is defined as water used for domestic purposes, drinking, cooking and personal hygiene. Access to drinking water means that the source is less than 1 kilometer away from its place of use and that it is possible to reliably obtain at least 20 litres per member of a household per day. While safe drinking water is water with microbial, chemical and physical characteristics that meet WHO guidelines or national standards on drinking water quality. An improved drinking-water source is defined as

one that, by nature of its construction or through active intervention, is protected from outside contamination, in particular from contamination with fecal matter ([WHO-UNICEF Joint Monitoring Programme 2015](#)).

Populations using a basic drinking-water source (piped water into dwelling, yard or plot; public taps or standpipes; boreholes or tubewells; protected dug wells; protected springs and rainwater) which is located on premises and available when needed; free of fecal (and priority chemical) contamination and/or regulated by a competent authority. The indicator is the ratio of the number of people who use a safely managed drinking-water service, urban and rural, expressed as a percentage. This was one of the MDGs and is set to be an indicator for the SDGs ([IAEG-SDGs 2015b](#)).

### **Open defecation: use of toilets (percent of households)**

Inadequate hygiene practice is among the underlying causes of poor nutrition. Poor sanitation leads to diseases that may influence utilisation of food and lead to nutrient deficiency in the body and ultimately food and nutrition insecurity. This indicator measures availability and use of toilets. About 946 million people practice open defecation and 9 out of 10 people who practice open defecation live in rural settings ([WHO-UNICEF Joint Monitoring Programme 2015](#)). Open defecation is the absence of sanitation, meaning the lack of facilities or failure to use facilities and services for the safe and hygienic disposal of human urine and faeces. An improved sanitation facility is defined as one that hygienically separates human excreta from human contact, limiting the transmission of diseases like diarrhea and intestinal worms that interferes with food utilisation in the body leading to malnutrition.

It should be noted that, having physical facilities (toilets) is one thing, but this has to be accompanied by conditions or practices conducive to maintaining health and preventing disease, especially through cleanliness and for this to happen there must be provision of clean water and education on hygiene practices. Inadequate sanitation is a major cause of disease worldwide and improving sanitation is known to have a significant beneficial impact on health both in households and across communities. The word 'sanitation' also refers to the maintenance of hygienic conditions, through services such as garbage collection and wastewater disposal as well as hygiene practices. Hygiene mostly refers to practices that prevent spread of disease-causing organisms. This aspect of hygiene is not included in the assessment of sanitation. Partly due to the reason that hygiene practices do vary widely, and what is considered acceptable in one culture might not be acceptable in another. This suggests a potential role for additional indicators such as the presence and use of handwashing stations, and the availability of soap for handwashing.

## **Composite indexes and multidimensional measures**

Composite indexes combine different dimensions to rank or classify different factors in a standardized way, providing a summary statistic for overall performance over time. An infinite number of such indexes could be constructed, and a very large number have been proposed and used at one time or another. Each index is typically developed by a particular organization, to capture a combination of factors they argue are particularly important for their mission. The specific indicators and associated weights determine the results, and are selected and interpreted in reference to the specific objective of the index.

There is considerable debate on the merits of composite indexes versus individual variables to describe a phenomenon, particularly in the domain of poverty measurement ([Ravallion 2011](#), [Alkire et al. 2012](#)). Where the components and weights reflect a single, clearly-defined concept, the resulting measure is usually treated as an indicator measuring that specific phenomenon. The term “composite index” is usually reserved for rankings or classifications across multiple dimensions, where the choice of which dimensions to include and the relative weights among them is not predetermined.

For nutrition purposes, composite indexes combining multiple concepts are generally aimed at facilitating advocacy, to stimulate and guide policymakers towards specific actions. One danger in these indices arises when they claim to have measured a phenomenon in a holistic manner, which can be misleading because the index components and weights actually measure different things. Another danger is that rankings can lead to complacency among those at the top, or frustration among those at the bottom if they are unable to rise.

For the purposes of this User's Guide, our conclusion is that composite indices are helpful when they highlight rather than obscure the individual indicators from which they are calculated. Publicizing a composite index can stimulate interest in the underlying data, and drive improvements in the collection and use of valuable information. As a result, composite indexes should be seen as attractive for advocacy, while for operational and strategic purposes one needs to examine specific indicators individually. This conclusion is clearly illustrated by the four examples of composite indexes described briefly below in chronological order of their introduction.

### **The Global Hunger Index (GHI)**

IFPRI's Global Hunger Index ([GHI](#)) was introduced in 2006 to stimulate policy action by pointing out poor performers and hailing success stories. To dramatize outcomes of greatest concern to policymakers, the Global Hunger Index initially used three equally weighted components, namely the prevalence of undernourishment (PoU), the mortality

rate for children under five, and the prevalence of underweight in children under five. In 2015, the underweight measure was replaced with two equally-weighted measures: prevalence of stunting (low height for age), and of wasting (low weight for height). As a result the index is now based on PoU and child mortality each with a weight of 1/3, and child stunting and child wasting each with a weight of 1/6. The index is published annually, but year-to-year variation often depends primarily on changes in PoU since mortality, stunting and wasting are not measured every year.

### **The Global Food Security Index (GFSI)**

The Global Food Security Index (GFSI) was developed in 2012 by a media and consulting firm, The Economist Intelligence Unit (EIU), with funding from DuPont, an agricultural input supplier. The index covers 109 countries in terms of 20 underlying variables based on affordability, availability, and quality and safety of foods ([GFSI 2015](#)). While the construction of the GFSI is transparent, the number and diversity of components limits its usefulness, except to draw attention to the issue of food security in general.

### **The Global Hidden Hunger Index (GHHI)**

The Global Hidden Hunger Index (GHHI) was introduced in 2013 through an effort led by Sight and Life, a humanitarian think tank funded by DSM, a manufacturer of food ingredients and micronutrient supplements. The GHHI is constructed through equal weighting of three underlying indicators: prevalence of stunting, anemia due to iron deficiency, and low serum retinol concentration. A fourth micronutrient-based indicator, prevalence of iodine deficiency, was found to be weakly correlated with the other three indicators and not used in the composite index. For the purposes of the GHHI, stunting is interpreted in relation to zinc deficiency.

### **The Hunger and Nutrition Commitment Index (HANCI)**

The Institute of Development Studies (IDS) developed its Hunger and Nutrition Commitment Index ([HANCI](#)) in 2015, to compare and rank 45 developing countries based on 22 indicators of political commitment to hunger reduction (10 indicators) and undernutrition (12 indicators). HANCI designers argue that its operationalization references key dimensions of food availability, access, stability and utilization, and actively seeks to address food, care-related and other non-food aspects of nutrition ([te Lintelo and Lakshman 2015](#)).

Looking across the four examples described above, it is clear that the formulation of composite indexes is valuable to highlight a specific set of indicators in terms of a common theme. IFPRI's Global Hunger Index very effectively highlights three (and now four) aspects of human well-being that policymakers care deeply about, linking them together as symptoms of hunger and food insecurity. The EIU/DuPont Global Food Security Index adds up a much larger number of indicators, presumably to emphasize

the value of agricultural inputs for all aspects of the food supply. Similarly, the work of Sight and Life on the Global Hidden Hunger Index is helpful to focus attention on micronutrients, and the work of IDS on HANCI turns attention to political commitment. Each of these advocacy tools is closely tied to the mission of its sponsoring organization, and should therefore be interpreted in that context.

## **Annex 1: Role of indicators in assessing progress towards the SDGs**

The main text of this report details how indicators can best be used in a wide range of policy and program settings. Many users are specifically concerned with the Sustainable Development Goals, listed in the table below. This is followed by a separate table with details on SDG 2, which calls on all UN member states to “End hunger, achieve food security and improved nutrition and promote sustainable agriculture.”

### **Box 3. The Sustainable Development Goals**

SDG 1: End poverty in all its forms everywhere

SDG 2: End hunger, achieve food security and improved nutrition and promote sustainable agriculture

SDG 3: Ensure healthy lives and promote well-being for all at all ages

SDG 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all

SDG 5: Achieve gender equality and empower all women and girls

SDG 6: Ensure availability and sustainable management of water and sanitation for all

SDG 7: Ensure access to affordable, reliable, sustainable and modern energy for all

SDG 8: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all

SDG 9: Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation

SDG 10: Reduce inequality within and among countries

SDG 11: Make cities and human settlements inclusive, safe, resilient and sustainable

SDG 12: Ensure sustainable consumption and production patterns

SDG 13: Take urgent action to combat climate change and its impacts

SDG 14: Conserve and sustainably use the oceans, seas and marine resources for sustainable development

SDG 15: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss

SDG 16: Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels

SDG 17: Strengthen the means of implementation and revitalize the global partnership for sustainable development



## Box 4. Targets and principal indicators used in SDG 2

<i>SDG 2: End hunger, achieve food security and improved nutrition and promote sustainable agriculture</i>	
<b>Targets</b>	<b>Indicators</b>
2.1 by 2030 end hunger and ensure access by all people, in particular the poor and people in vulnerable situations including infants, to safe, nutritious and sufficient food all year round	2.1.1. Prevalence of Undernourishment (PoU) 2.1.2. Prevalence of population with moderate or severe food insecurity (based on the Food Insecurity Experience Scale, FIES)
2.2 by 2030 end all forms of malnutrition, including achieving by 2025 the internationally agreed targets on stunting and wasting in children under five years of age, and address the nutritional needs of adolescent girls, pregnant and lactating women, and older persons	2.2.1. Prevalence of stunting and wasting among children less than five years of age
2.3 by 2030 double the agricultural productivity and the incomes of small-scale food producers, particularly women, indigenous peoples, family farmers, pastoralists and fishers, including through secure and equal access to land, other productive resources and inputs, knowledge, financial services, markets, and opportunities for value addition and non-farm employment	2.3.1. Volume of production per labour unit (measured in constant USD), by classes of farming/pastoral/forestry enterprise size
2.4 by 2030 ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters, and that progressively improve land and soil quality	2.4.1. Percentage of agricultural area under sustainable agricultural practices

### Box 4 (continued)

Targets	Indicators
2.5 by 2020 maintain genetic diversity of seeds, cultivated plants, farmed and domesticated animals and their related wild species, including through soundly managed and diversified seed and plant banks at national, regional and international levels, and ensure access to and fair and equitable sharing of benefits arising from the utilization of genetic resources and associated traditional knowledge as internationally agreed	2.5.1. Ex situ Crop Collections Enrichment Index
<i>2.a.increase investment, including through enhanced international cooperation, in rural infrastructure, agricultural research and extension services, technology development, and plant and livestock gene banks to enhance agricultural productive capacity in developing countries, in particular in least developed countries</i>	2. a.1. Agriculture Orientation Index for Government Expenditures
<i>2.b. correct and prevent trade restrictions and distortions in world agricultural markets including by the parallel elimination of all forms of agricultural export subsidies and all export measures with equivalent effect, in accordance with the mandate of the Doha Development Round</i>	2. b.1. Percent change in Import and Export tariffs on agricultural products 2. b.2. Agricultural Export Subsidies
<i>2.c. adopt measures to ensure the proper functioning of food commodity markets and their derivatives, and facilitate timely access to market information, including on food reserves, in order to help limit extreme food price volatility</i>	2. c.1. Indicator of (food) Price Anomalies (IPA)

The main text provides a conceptual framework (Figure 5) showing: (1) causality among the SDG 2 targets, (2) between SDG2 and other SDGs and (3) all the indicators assessed by the TWG which relate to the SDG2 but which are not included in SDG 2. In this framework, all of the SDG 2 targets and indicators are in the center of the figure marked by pink dotted lines, with blue arrows showing causality among the SDG 2 targets. All other SDGs which are critical for achieving SDG 2 are in the blue boxes with gray arrows showing the causal pathways between SDG 2 targets and other SDGs. The red boxes in that figure show which indicators are missing from the SDG 2. They are marked by yellow arrows with red question marks in appropriate places. All of the indicators assessed by the TWG in support of particular SDG 2 targets (noticeable in red dotted arrows) are in the yellow boxes in terms of the corresponding commitment and capacity indicators or outcome indicators. In figure 5 they are only marked by box numbers, so below Box 5 provides the list of indicators for each box.

### Box 5. Indicators used to measure progress towards SDG 2

Box No.	Indicators
Box 1: TWG Supporting Indicators (Outcomes)	1. Dietary energy in the food supply (kcal/capita, or percent of requirements) 2. Average supply of protein (grams/cap/day) 3. Protein from animal sources (grams per capita per day) 4. Share of calories from non-staples (%) 5. Modified Functional Attribute Diversity Index (measure of diversity in nutrient production/supply) 6. Shannon Entropy Index (measure of diversity of food production/supply) 7. Per capita food supply variability 8. Diversity of foods available in local markets (number of distinct foods or food groups) 9. Household Dietary Diversity Score 10. Food Consumption Score 11. Infant and Young Child Dietary Diversity Score, 12. Infant and Young Child Minimum Acceptable Diet 13. Minimum Dietary Diversity -- Women) 14. Dietary energy from household expenditure surveys (HES) 15. Healthy Eating Index 16. Healthy Item Score 17. Unhealthy Item Score
Box 2: TWG Supporting Indicators (Outcomes)	1. Food price indexes (local food prices relative to other prices) 2. Food affordability indexes (food prices relative to labor wages or income) 3. Household food expenditure (share of total spending)

# Box 5 (continued)

Box 3: TWG Supporting Indicators (Outcomes)	1. Drinking water: use of clean water sources (percent of households) 2. Open defecation: Use of toilets (percent of households)
Box 4: TWG Supporting Indicators (Outcomes)	1. Adult and adolescent Body Mass Index (percent underweight, overweight or obese) 2. Child underweight: weight-for-age (percent of children) 3. Child weight and overweight (percent overweight) 4. Low and very low birthweight (LBW and VLBW) (percent of births) 5. Diarrhea -- Incidence of food and waterborne diarrhea (percent of children) 6. Adult raised blood glucose (percent) 7. Adult raised blood pressure (percent) 8. Adult raised cholesterol levels (percent)
Box 5: TWG Supporting Indicators (Outcomes)	1. Micronutrient intakes from household expenditure surveys (HES) / Micronutrient Adequacy relative to requirements 2. Mean (Micro) Nutrient Density 3. Breastfeeding: initiation, exclusivity and continuation (percent of children) 4. Iodized salt consumption (percent) 5. Oral rehydration (percent of under 5 with diarrhea receiving ORS, percent of cases)
Box 6: TWG Supporting Indicator (Outcome)	1. Birth timing (maternal age at first birth, months between births)
Box 7: TWG Supporting Indicators (Outcomes)	1. Depth of food deficit (kcal/capita/day, based on Prevalence of Undernourishment data) 2. Women of reproductive age short stature (percent low height) 3. Women of reproductive age thinness (percent low BMI) 4. Anemia among women and children (percent of population) 5. Iodine deficiency (percent) 6. Vitamin A deficiency and supplementation coverage (percent of pre-school age children) and Experienced-based Scales (index values) -- 1. Household Hunger Scale (HHS) 2. Household Food Insecurity Access Scale (HFIAS)
Box 8: TWG Supporting Indicator (Outcome)	1. Volatility of food prices (standard deviations of prices over time)

## Box 5 (continued)

Box 9: TWG Supporting Indicator (Commitment and Capacity)	1. Right to Food
Box 10: TWG Supporting Indicator (Commitment and Capacity)	1. Share of public budget spent on nutrition and allied programs
Box 11: TWG Supporting Indicator (Commitment and Capacity)	1. Government Expenditure on Agriculture
Box 12: Early Warning Systems (Commitment and Capacity) <i>[Omitted from User's Guide]</i>	1. Global Information and Early Warning System on Food and Agriculture (GIEWS) 2. Famine Early Warning Systems Network (FEWS NET) 3. Emergency Prevention System (EMPRES) 4. Vulnerability Analysis and Mapping (VAM) – (Using several tools – 1. Comprehensive Food Security and Vulnerability Analysis (CFSVA) 2. Crop and Food Security Assessment Mission (CFSAM) 3. Emergency Food Security Assessment (EFSA) 4. Food Security Monitoring System (FSMS) 5. Joint Assessment Mission (JAM) 6. Market Analysis) 5. Cadre Harmonisé 6. Food Security Information and Early Warning System (FSIEWS) 7. Coping Strategies Index (CSI) 8. Integrated Food Security Phase Classification (IPC) 9. Agricultural Market Information System (AMIS) 10. Locust Watch
Box 13: TWG assessed Composite Indices	1. Hunger and Nutrition Commitment Index (HANCI) 2. Global Food Security Index (GFSI) 3. Global Hunger Index (GHI) 4. Global Hidden Hunger Index 5. Food Security Commitment and Capacity Profile (FSCCP)

For readers who are concerned with other global policy commitments, the table below shows how the indicators covered by this TWG assessment relate to the CAADP Results Framework (2015-2025), the FAO's Food Security Indicators and the Malabo Targets, in addition to SDG 2.

### Box 6. Indicators assessed by the TWG in the context of the CAADP Results Framework

Results Area	Priority Indicators for CAADP Results Framework (2015-2025)	TWG Covers	SDG 2	FAO's Food Security Indicators	Contribution to measurement of Malabo Targets
1.1. Wealth creation	1.1.1 GDP per capita (constant 2005 US\$)			✓ (in purchasing power equivalent)	
	1.1.2 Household final consumption expenditure (constant 2005 US\$)				
1.2. Food and nutrition security	1.2.1 Prevalence of undernourishment (%)	✓	✓ (2.1.1)	✓	IIIId
	1.2.2 Status of malnutrition:				
	a) Prevalence of underweight	✓		✓	IIIId
	b) Prevalence of stunting	✓	✓ (2.2.1)	✓	IIIId
	c) Prevalence of wasting	✓		✓	IIIId
	d) Minimum dietary diversity - women	✓			IIIId
	e) Minimum acceptable diet for 6-23 months old infants	✓			IIIId
	1.2.3 Cereal import dependency ratio			✓	Ia
1.3. Economic opportunities, poverty eradication and shared prosperity	1.3.1 Employment rate (% of population)				
	1.3.2 Number of jobs created per annum by age category and sex				
	1.3.3 Poverty gap at national line				
	1.3.4 Extreme Poverty headcount ratio at \$1.25/day				
	1.3.5 Gini coefficient				

**Box 6 (continued)**

1.4. Resilience and sustainability	1.4.1 Percent of households that are resilient to climate and weather related shocks				VIa
	1.4.2 Human sustainable development index				
2.1. Increased agriculture production and productivity	2.1.1 Agriculture value added (absolute values)				Ia and IVa
	2.1.2 Agriculture production index (2004-2006=100)			Average value of food production	IIIa
	2.1.3 Agriculture value added per agricultural worker (constant 2005 USD)		✓ (2.3.1)		IIIa
	2.1.4 Agriculture value added per hectare of arable land (constant 2005 USD)				IIIa
	2.1.5 Yields for the five most commodities				IIIa
2.2. Increased intra-African regional trade and better functioning of national & regional markets	2.2.1. Value of intra-African trade (constant 2005 US\$)				Va
	2.2.2 Domestic food price index volatility	✓		✓	Vb and Vic
2.3. Expanded local agro-industry and value chain development inclusive of women and youth	2.3.1 Percent of agricultural five priority products that is lost post-harvest				IIIb
	2.3.2 Activity and inclusive employment in industries related to agriculture value chains				IVc and IVd
2.4. Increased resilience of livelihoods and improved management of risks in the agriculture sector	2.4.1. Coverage of social assistance, social protection, social insurance and labour programs				IIIc and VIb
	2.4.2 Existence of food reserves, local purchases for relief programmes, early warning systems and food feeding programmes				IIIc



**Box 6 (continued)**

2.5. Improved management of natural resources for sustainable agriculture	2.5.1. Share of agriculture under sustainable land management practices		✓ (2.4.1)		VIc
3.1 Effective and inclusive policy design and implementation processes	3.1.1 Existence of a new NAIP/NAFSIP developed through an inclusive and participatory process				Id
3.2 Effective and accountable institutions including assessing implementation of policies and commitments	3.2.1 Existence of inclusive institutionalized mechanisms for mutual accountability and peer review				VIIa and VIIb
3.3 Strengthened capacity for evidence based planning, implementation & review	3.3.1 Existence of and quality in the implementation of evidence-informed policies and corresponding human resources				Ic
3.4 Improved multi-sectorial coordination, partnerships and mutual accountability in sectors related to agriculture	3.4.1 Existence of a functional multi-sectorial and multi-stakeholder coordination body				VIIb and Id
	3.4.2. Cumulative number of agriculture-related Public Private Partnerships (PPPs) that are successfully undertaken				Id and IVb
	3.4.3 Cumulative value of investments in the PPPs				IIa

**Box 6 (continued)**

3.5 Increased public and private investments in agriculture	3.5.1 Government agriculture expenditure growth rate (%)				IIa
	3.5.2 Share government agriculture expenditure (% of total government expenditure)	✓	2.a.1: Agriculture Orientation Index (AOI)		IIa
	3.5.3 Government agriculture expenditure as % of agriculture value added		2.a.1: Agriculture Orientation Index (AOI)		IIa
	3.5.4 Growth in Private sector investment in agriculture and agribusiness				IIb
3.6 Increased capacity to generate, analyze and use data, information, knowledge and innovations	3.6.1 Index of capacity to generate and use statistical data and information (ASDI)				VIIc
	3.6.2 Existence of an operational country SAKSS				VIIc

## Annex 2: Complete list of indicators by use in international targets or objectives

Details on each organization's targets, objectives and outcome measures are listed in the extended note below this table.

### Box 7. Indicators by use as international targets or objectives

Name of listing organization:	Selected organizations using each indicator as a target, objective or outcome measure										
	TWG	GNR	FAO	MDG	SDG	WHA/O	WB	CAADP	FFP	FtF	DFID
<i>Number of distinct indicators:</i>	33	17	12	2	20	13	11	10	9	11	2
<b>National observations</b>											
<i>Dietary energy in the food supply</i> (kcal/capita/day, or pct of requirements)	x	x	AV		2.1						
<i>Dietary quality of the food supply (g/capita</i> <i>of specific foods or nutrients)</i>	x										
Non-staple share of dietary energy (pct from foods other than cereals & starchy roots)		x									
Fruit and vegetables availability (g/capita/day, or pct of dietary energy)		x									
Protein availability (g/cap/day)											
<i>Diversity of the food supply</i> (Shannon-type indexes of functional attributes or foods)	x				2.5						
<i>Variability of the food supply</i> (standard deviations of kcal/capita over time)	x		S		2.2		2				
<i>Public expenditure and commitments</i> (percent of spending, or specific commitments)	x										
Share of expenditure (incl. health, education, nutrition, social protection & agriculture)		x			1.a.1			3.5.3*		S	
Public commitments (right to food legislation and food system regulation)							3	3.3.1*			

Name of listing organization:	Selected organizations using each indicator as a target, objective or outcome measure										
	TWG	GNR	FAO	MDG	SDG	WHA/O	WB	CAADP	FFP	FtF	DFID
<b>Market observations</b>											
<i>Domestic food price index</i> (local food prices relative to other prices)	x		AV/S		2.c			2.2.2			
<i>Food affordability indexes</i> (local food prices relative to labor earnings)	x										
<i>Volatility of food prices</i> (standard deviations of prices over time)	x		AV/S								
<b>Household and individual recall</b>											
<i>Food budget share</i> (pct of hhld expenditure spent on food)	x		AV				1	1.1.2			
<i>Dietary diversity</i> (# of food groups, or pct with low diversity)	x	x			2.1			1.2.2.d*	R	S	
Household diet diversity and the Food Consumption Score (FCS)											
Individual diet diversity for infants, children or women (eg Minimum Acceptable Diet)		x				Pro		1.2.2.e	RiA	Ria	
<i>Dietary energy from household surveys</i> (kcal/day per adult equivalent, or pct of requirements)	x				1.4.1						
<i>Diet quality indexes</i> (ratios, indexes or quantities of specific foods or nutrients)	x				1.4.1						
Non-staple share of dietary energy (pct from foods other than cereals & starchy roots)											
Dietary pattern scores (Healthy Eating Indexes, DASH or Mediterranean and others)											
<i>Nutrient adequacy</i> (pct relative to requirements)	x				1.4.1		3				

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Name of listing organization:	Selected organizations using each indicator as a target, objective or outcome measure										
	TWG	GNR	FAO	MDG	SDG	WHA/O	WB	CAADP	FFP	FtF	DFID
<i>Experience-based scales (household or individual)</i>	x				SI 2.1					Ria	
<i>Coping Strategies Index (CSI)</i>	x				3.d						
<b>Anthropometric measures</b>											
<i>Child height-for-age and stunting (pct stunted, or mean heights)</i>	x	×	U		2.2.1	RF	4	1.2.2.b	R	R	
<i>Child weight-for-height and MUAC (pct wasted)</i>	x	×	U			RF		1.2.2.c		R	
<i>Child weight-for-age and underweight (pct underweight)</i>	x		U	1.C 1.8		RF	4	1.2.2.a		R	
<i>Child weight and BMI (pct overweight or obese)</i>	x	×			2.2.2	core					
<i>Adolescent and adult BMI (pct overweight and obese)</i>	x	××	U			Int					
<i>*Women of reproductive age thinness (pct low BMI )</i>	x					Int			RiA		
<i>*Women of reproductive age short stature (% low height)</i>	x									R	
<i>Waist circumference (prevalence of underweight, overweight or obesity)</i>	x										
<b>Undernourishment</b>											
<i>Prevalence of Undernourishment: PoU (pct of population, or millions of people)</i>	x	×	AC	1.C 1.9	2.1.1		4	1.2.1	R		
<i>Depth of food deficit (kcal/capita/day, based on PoU data)</i>	x		AC		2.1		4				
<b>Biomarkers and clinical data</b>											
<i>Anemia among women and children (% of population)</i>	x	×				RF				Ria/S	
<i>Low and very low birthweight (LBW and VLBW) (% of births)</i>	x	×				RF					

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Name of listing organization:	Selected organizations using each indicator as a target, objective or outcome measure										
	TWG	GNR	FAO	MDG	SDG	WHA/O	WB	CAADP	FFP	FtF	DFID
Vitamin A deficiency rates and supplementation coverage (pct of children)	x	x	U				3			S	
<b>Breastfeeding and sanitation</b>											
Breastfeeding: initiation, exclusivity and continuation (pct of children)	x	x			2.2.2	RF			RiA	Ria	
Diarrhea: incidence and treatment with ORS and/or zinc (pct of children)	x				6	Int			RiA		
Drinking water: use of clean sources (pct or number of households)	x	x x			1.4.1, 6.1.1	Pro	3		RiA		x
Open defecation: use of toilets (pct or number of households)	x	x x			1.4.1, 6.1.1	Pro	3		RiA		x
<b>Composite indexes and multidimensional measures</b>											
The Global Hunger Index (GHI)	x										
The Global Food Security Index (GFSI)	x										
The Global Hidden Hunger Index (GHHI)	x										
The Hunger and Nutrition Commitment Index (HNCI)	x										
<b>Related indicators not specifically addressed in the User's Guide</b>											
<b><u>Agricultural production and productivity</u></b>											
Value of food production per capita			AC								
Value of food production per hectare					2.3.1			2.1.4	RiA	Ria	
Value of agricultural production per worker							2	2.1.3			
Variability of food production per person			S								
Prevalence of food inadequacy			AV				1				
Percentage of arable land equipped for irrigation (%)			S							Ria/Wog	
Cereal import dependency ratio (%)			S					1.2.3			

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Name of listing organization:	Selected organizations using each indicator as a target, objective or outcome measure										
	TWG	GNR	FAO	MDG	SDG	WHA/O	WB	CAADP	FFP	FtF	DFID
Value of imports over total merchandise exports (%)			S								
Communities where food prices have significantly increased					2.c.1						
<b><u>Sustainability of ag. and food systems</u></b>											
Volume of water withdrawn from water sources				7.B 7.5	6.4.1						
Area of land under forests and woods				7.B 7.1							x
Proportion of fish stocks within safe biological limits				7.B 7.4							
Proportion of hhlds with adequate water and fodder for livestock					5.4.2						
Fossil fuel use in agriculture					7						
Global Food Loss Index					12.3.1		2				
Access to clean energy											x
Coping with climate change											x
Land under sustainable practices											
Soil erosion rate											
<b><u>Health</u></b>											
Iodine deficiency or iodized salt consumption (%)		x	U								
Child mortality, <5 (deaths per 1,000 live births)				4.A 4.1	3.2.1	H Stat, core					
Infant mortality, incl. perinatal and neonatal					3.2.2						x
Maternal mortality (per 100,000 live births)				5.A 5.1	3.1.1	H Stat, core					x
Prevalence of premature deliveries											
Skilled attendant at birth (%)				5.A 5.2	3.1.2	Ser, (core)					x



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Name of listing organization:	Selected organizations using each indicator as a target, objective or outcome measure										
	TWG	GNR	FAO	MDG	SDG	WHA/O	WB	CAADP	FFP	FtF	DFID
Antenatal care (4+ visits) (%)		x							RIA		
Insecticide-treated bednets (number)											x
Malaria-specific deaths (per 100,000 persons)											x
Adult raised blood glucose (%)											
Adult raised blood pressure (%)											
Adult raised cholesterol levels (%)											
<b><u>Gender dynamics</u></b>											
Women's land tenure rights					1.4.2					Ria/WoG	x
Women's ownership of other resources					5.5.2						
Women's empowerment indexes					5.5			1.3.1*			
Women's employment and wages				3.A*	5.5						
Women's role in policies and politics					5.5.1					R	
Women and girls with access to security and justice services											x
Female schooling and education levels				3.A							x
Gender differences in health outcomes											
<b><u>Family planning</u></b>											
Women's use of modern family planning methods											x
Women's age at first birth, age at marriage											
<b><u>Food and nutrition policies</u></b>											
Wheat fortification legislation		x									
Nutrition/Undernutrition in national development plans and economic growth strategies										Ria	
Availability and stage of implementation of guidelines, protocols, and standards for the management of diabetes		x			3.4.1						
		x									

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Name of listing organization:	Selected organizations using each indicator as a target, objective or outcome measure										
	TWG	GNR	FAO	MDG	SDG	WHA/O	WB	CAADP	FFP	FtF	DFID
Availability and stage of implementation of guidelines, protocols, and standards for the management of hypertension											
Scaling up Nutrition (SUN) countries' Institutional Transformations		×									
National Implementation of the International Code of Marketing of Breast Milk Substitutes		×									
Maternity protection (Convention 183)		×									
Women's rights and care practices					5.5						
Children's rights and care practices											
<b><u>Infrastructure</u></b>											
Percent of communities without physical access to functioning markets											
Road quality (pct. of roads that are paved)			AV				2		RiA	Ria/WoG	
Road density (per 100 sq km of land area)			AV				2				
Rail lines density (per 100 sq km of land area)			AV								
<b><u>Crises and conflict</u></b>											
Losses from crises and disasters							3				
*Political stability and absence of violence/terrorism (index)			S								
<b><u>Program monitoring, evaluation and measurement of results</u></b>											
Beneficiaries receiving specified agricultural inputs, services and vouchers										×	
Beneficiaries receiving specified nutritional and food items, services and vouchers								2.4.2*		×	
Quantity of fortified foods and nutritional products distributed										×	

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		Selected organizations using each indicator as a target, objective or outcome measure										
Name of listing organization:		TWG	GNR	FAO	MDG	SDG	WHA/O	WB	CAADP	FFP	FtF	DFID
<b><u>Education</u></b>												
	School attendance					4.1.2						
	Increase in awareness among key population groups (education/sensitization)											
<b><u>Financial services</u></b>												×
<b><u>Governance and accountability</u></b>												
	Freer and fairer elections											×
	Number of people who vote											×
	Number of people with choice and control, holding decision-makers to account											×

## Notes for Annex 2, by organization or development agency:

### GNR, IFPRI

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Indicators from: <http://globalnutritionreport.org/files/2014/07/Country-Profile-Indicators-Table.pdf>

Also consider: Nugent, Rachel; Levin, Carol; Grafton, Daniel; Fanzo, Jessica; Remans, Roseline; Anderson, C. Leigh. 2015. Indicators for nutrition-friendly and sustainable food systems. In Global Nutrition Report 2015: Actions and accountability to advance nutrition and sustainable development. Chapter 7. Pp. 85-96. Washington, DC: International Food Policy Research Institute (IFPRI).

<http://ebrary.ifpri.org/cdm/ref/collection/p15738coll2/id/129442>

- Also breaks out overweight and obese for adults
- "Available calories from meat" considered but not reported
- "From FAO" presumed to mean Food Balance Sheets for food availability indicators
- Blood pressure, blood glucose, blood cholesterol reported
- Skilled birth attendants
- Break breastfeeding indicators out: Early initiation of breastfeeding (within 1 hour of birth); Continued breastfeeding at one year
  - Report on specific intervention coverage: Severe acute malnutrition; Immunization Coverage DPT3
- "Minimum dietary diversity"
- Early childbearing births
- Gender inequality index
- Population density of health workers
- Female secondary education enrollment
- They break out drinking water and sanitation into 2 distinct indicators and further by:
  - Improved drinking water = piped on premises/other improved/unimproved/surface water
  - Sanitation = improved/shared/unimproved/open defecation
- Policy and legislative provisions:
  - "Constitutional right to food"
  - Undernutrition mentioned in national development plans and economic growth strategies

## USAID FtF Indicators

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<http://feedthefuture.gov/resource/feed-future-handbook-indicator-definitions>

- F standard program structure. F measures designed to measure what is being accomplished with foreign assistance from State and USAID, meant to measure outputs that are directly attributable to USG programs as well as outcomes and impacts to which the U.S. Government contributes but are not due solely to U.S. Government-funded interventions
  - **(R)** = Required indicator
  - **(RiA)** = Required if Applicable indicator
  - **(S)** = Standard indicator
  - **(WOG)** = Whole of Government Indicator
- FtF indicators fall into one of three groups: Zone of Influence, National/Regional, and Implementing Mechanism - the majority of indicators are Implementing Mechanism Indicators
- Prevalence of underweight women NOT the same thing as "Women of reproductive age short stature (pct low height)"
- Anemia broken out into two: women & children
- Prevalence of households with moderate or severe hunger (RiA)
- Number of health facilities with established capacity to manage acute undernutrition (S)
- Number of children under five who received Vitamin A from USG-supported programs (S)
- "Number of USG social assistance beneficiaries participating in productive safety nets (S)"
- Prevalence of Poverty: Percent of people living on less than \$1.25/day (R)
- Depth of Poverty: The mean percent shortfall relative to the \$1.25 poverty line (RiA)
- Number of jobs attributed to Feed the Future implementation (RiA)
- Daily per capita expenditures (as a proxy for income) in USG-assisted areas (R)
- Total increase in installed storage capacity (m3) (S)
- Women's Empowerment in Agriculture Index is a very specific measure...
- Numbers of Policies/Regulations/Administrative Procedures in each of the following stages of development as a result of USG assistance in each case: Stage 1: Analyzed; Stage 2: Drafted and presented for public/stakeholder consultation; Stage 3: Presented for legislation/decreed; Stage 4: Passed/approved; Stage 5: Passed for which implementation has begun (S)
- Number of national-level policies required for full implementation of a regionally agreed-upon policy progressing through necessary steps as a result of USG assistance (S)
- Number of hectares of land under improved technologies or management practices as a result of USG assistance (RiA)(WOG)
- Number of farmers and others who have applied improved technologies or management practices as a result of USG assistance (RiA) (WOG)
- Number of individuals who have received USG supported long-term agricultural sector productivity or food security training (S)
- Number of individuals who have received USG supported short-term agricultural sector productivity or food security training (RiA) (WOG)
- Number of food security private enterprises (for profit), producers organizations, water users associations, women's groups, trade and business associations, and community-based organizations (CBOs) receiving USG assistance (RiA) (WOG)

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- Number of public-private partnerships formed as a result of Feed the Future assistance (S)
- Number of rural households benefiting directly from USG interventions (S)
- Number of vulnerable households benefiting directly from USG assistance (S)
- Value of incremental sales (collected at farm-level) attributed to Feed the Future implementation (RiA)
- Number of members of producer organizations and community based organizations receiving USG assistance (S)
- Value of Agricultural and Rural Loans (RiA) (WOG)
- Number of MSMEs, including farmers, receiving USG assistance to access loans (S)
- Number of people implementing risk-reducing practices/actions to improve resilience to climate change as a result of USG assistance (S)
- Percent change in value of intra-regional trade in targeted agricultural commodities (RiA)
- Value of exports of targeted agricultural commodities as a result of USG assistance (S)
- Number of MSMEs, including farmers, receiving business development services from USG assisted sources (S)
- Value of new private sector investment in the agriculture sector or food chain leveraged by Feed the Future implementation (RiA)
- Number of technologies or management practices in one of the following phases of development: Phase I: under research as a result of USG assistance; Phase II: under field testing as a result of USG assistance; Phase III: made available for transfer as a result of USG assistance (S)
- Number of private enterprises, producers organizations, water users associations, women's groups, trade and business associations and community-based organizations (CBOs) that applied improved technologies or management practices as a result of USG assistance (RiA) (WOG)
- Number of firms (excluding farms) or Civil Society Organizations (CSOs) engaged in agricultural and food security-related manufacturing and services now operating more profitably (at or above cost) because of USG assistance (RiA)
- Nutrition indicators apparently spread across USAID – no master list

## FAO

<http://www.fao.org/economic/ess/ess-fs/ess-fadata/en/#.VnmCkvkrLIU>

Food security indicators divided into:

Availability (AV), Access (A), Stability (S), and Utilization (U)

- FAO indicator "Share of dietary energy supply derived from cereals, roots and tubers" not the same as 'Non-staple share of dietary energy from Food Balance Sheets (kcal from foods other than cereals & starchy roots, as pct of total)'
- Average protein supply rather than "Milk and meat availability from FBS"
- Gross domestic product per capita (in purchasing power equivalent)
- Domestic food price index (level or volatility over time), FAO has a separate indicator for volatility
- Access to improved water sources (FAO) not the same thing as use (FSIN)
- Access to improved sanitation facilities (FAO) not the same thing as use (FSIN)
- Anemia among women and children (FSIN) FAO asks specifically about pregnant women
- Prevalence of anemia among children under 5 years of age

## WHA/WHO Core

<http://www.who.int/healthinfo/indicators/2015/en/> (Core 100)

[http://www.who.int/nutrition/topics/proposed\\_indicators\\_framework/en/](http://www.who.int/nutrition/topics/proposed_indicators_framework/en/)

The core set includes tracer indicators at different stages of the results chain:

1. **primary outcome indicators** that measure progress towards the six global nutrition targets;
2. **intermediate outcome indicators** that will monitor how specific diseases and conditions on the causal pathways affect countries' trends towards the six targets;
3. **process indicators** that monitor program and situation-specific progress;
4. **policy environment** and capacity indicators that measure the political commitment of a country and its capacities to implement nutrition interventions.

From core set NOT included by FSIN:

- Percentage of births in baby friendly facilities (kind of like skilled birth attendants...?)
- Proportion of mothers of children aged 0–23 months who have received counselling, support or messages on optimal breastfeeding at least once in the last year\*
- Number of trained nutrition professionals per 100 000 population\*
- Country has legislation/regulations fully implementing the International Code of Marketing of Breast-milk Substitutes (resolution WHA34.22) and subsequent relevant resolutions adopted by the Health Assembly
- Country has maternity protection laws or regulations in place in line with the ILO Maternity Protection Convention, 2000 (No. 183) and Recommendation No. 191



### **The WHO Core 100**

"The Global Reference List," is a standard set of 100 core indicators prioritized by the global community to provide concise information on the health situation and trends, including responses at national and global levels.

1. The indicator is prominent in the monitoring of major international declarations to which all member states have agreed, or has been identified through international mechanisms such as reference or interagency groups as a priority indicator in specific programme areas.
2. The indicator is scientifically robust, useful, accessible, understandable as well as specific, measurable, achievable, relevant and timebound (SMART).
3. There is a strong track record of extensive measurement experience with the indicator (preferably supported by an international database).
4. The indicator is being used by countries in the monitoring of national plans and programmes.

### **Health Status (H Stat):**

- Mortality by age and sex
- Life expectancy at birth
- Adult mortality rate between 15 and 60 years of age
- Under-five mortality rate
- Neonatal mortality rate
- Stillbirth rate Mortality by cause
- TB mortality rate
- AIDS-related mortality rate
- Malaria mortality rate
- Mortality between 30 and 70 years of age from cardiovascular diseases, cancer, diabetes or chronic respiratory diseases
- Suicide rate
- Mortality rate from road traffic injuries Fertility
- Adolescent fertility rate
- Total fertility rate Morbidity
- New cases of vaccine-preventable diseases
- New cases of IHR-notifiable diseases and other notifiable diseases
- HIV incidence rate
- HIV prevalence rate
- Hepatitis B surface antigen prevalence
- Sexually transmitted infections (STIs) incidence rate
- TB incidence rate
- TB notification rate
- TB prevalence rate
- Malaria parasite prevalence among children aged 6–59 months
- Malaria incidence rate

- Cancer incidence, by type of cancer

**Risk Factors (RF):**

*Infections*

- Condom use at last sex with high-risk partner

*Environmental risk factors*

- Population using safely managed drinking-water services
- Population using safely managed sanitation services
- Population using modern fuels for cooking/heating/lighting
- Air pollution level in cities

*Noncommunicable diseases*

- Total alcohol per capita (age 15+ years) consumption
- Tobacco use among persons aged 18+ years
- Children aged under 5 years who are overweight
- Overweight and obesity in adults (Also: adolescents)
- Raised blood pressure among adults
- Raised blood glucose/diabetes among adults
- Salt intake
- Insufficient physical activity in adults (Also: adolescents)
- Injuries
- Intimate partner violence prevalence

**Service Coverage Indicators (Ser)**

- Demand for family planning satisfied with modern methods
- Contraceptive prevalence rate
- Antenatal care coverage
- Births attended by skilled health personnel
- Postpartum care coverage
- Care-seeking for symptoms of pneumonia
- Children with diarrhea receiving oral rehydration solution (ORS)
- Vitamin A supplementation coverage
- Immunization coverage rate by vaccine for each vaccine in the national schedule
- People living with HIV who have been diagnosed
- Prevention of mother-to-child transmission
- HIV care coverage
- Antiretroviral therapy (ART) coverage
- HIV viral load suppression

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- TB preventive therapy for HIV-positive people newly enrolled in HIV care
- HIV test results for registered new and relapse TB patients
- HIV-positive new and relapse TB patients on ART during TB treatment
- TB patients with results for drug susceptibility testing
- TB case detection rate
- Second-line treatment coverage among multidrug-resistant tuberculosis (MDR-TB) cases
- Intermittent preventive therapy for malaria during pregnancy (IPTp)
- Use of insecticide treated nets (ITNs)
- Treatment of confirmed malaria cases
- Indoor residual spraying (IRS) coverage
- Coverage of preventive chemotherapy for selected neglected tropical diseases
- Cervical cancer screening
- Coverage of services for severe mental health disorders

### **Health Systems**

- Perioperative mortality rate
- Obstetric and gynaecological admissions owing to abortion
- Institutional maternal mortality ratio
- Maternal death reviews
- ART retention rate
- TB treatment success rate
- Service-specific availability and readiness
- Service utilization
- Health service access
- Hospital bed density
- Availability of essential medicines and commodities
- Health worker density and distribution
- Output training institutions
- Birth registration coverage
- Death registration coverage
- Completeness of reporting by facilities
- Total current expenditure on health (% of gross domestic product)
- Current expenditure on health by general government and compulsory schemes (% of current expenditure on health)
- Out-of-pocket payment for health (% of current expenditure on health)
- Externally sourced funding (% of current expenditure on health)
- Total capital expenditure on health (% current + capital expenditure on health)

- Headcount ratio of catastrophic health expenditure
- Headcount ratio of impoverishing health expenditure
- International Health Regulations (IHR) core capacity index

## MDGs

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<http://mdgs.un.org/unsd/mdg/data.aspx>

Indicators NOT including in FSIN TWG list broken down by goal/target/indicator

### **Goal 1: Eradicate extreme poverty and hunger**

#### **Target 1.A: Halve, between 1990 and 2015, the proportion of people whose income is less than one dollar a day**

- 1.1 Proportion of population below \$1.25 (PPP) per day
- 1.2 Poverty gap ratio
- 1.3 Share of poorest quintile in national consumption

#### **Target 1.B: Achieve full and productive employment and decent work for all, including women and young people**

- 1.4 Growth rate of GDP per person employed
- 1.5 Employment-to-population ratio
- 1.6 Proportion of employed people living below \$1.25 (PPP) per day
- 1.7 Proportion of own-account and contributing family workers in total employment

### **Goal 2: Achieve universal primary education**

#### **Target 2.A: Ensure that, by 2015, children everywhere, boys and girls alike, will be able to complete a full course of primary schooling**

- 2.1 Net enrolment ratio in primary education
- 2.2 Proportion of pupils starting grade 1 who reach last grade of primary
- 2.3 Literacy rate of 15-24 year-olds, women and men

### **Goal 3: Promote gender equality and empower women**

#### **Target 3.A: Eliminate gender disparity in primary and secondary education, preferably by 2005, and in all levels of education no later than 2015**

- 3.1 Ratios of girls to boys in primary, secondary and tertiary education
- 3.2 Share of women in wage employment in the non-agricultural sector\*\* FSIN indicator does not distinguish b/t sectors
- 3.3 Proportion of seats held by women in national parliament

### **Goal 4: Reduce child mortality**

#### **Target 4.A: Reduce by two-thirds, between 1990 and 2015, the under-five mortality rate**

- 4.3 Proportion of 1 year-old children immunized against measles

### **Goal 5: Improve maternal health**

#### **Target 5.B: Achieve, by 2015, universal access to reproductive health**

- 5.3 Contraceptive prevalence rate

- 5.4 Adolescent birth rate
- 5.5 Antenatal care coverage (at least one visit and at least four visits)
- 5.6 Unmet need for family planning

**Goal 6: Combat HIV/AIDS, malaria and other disease**

**Target 6.A: Have halted by 2015 and begun to reverse the spread of HIV/AIDS**

- 6.1 HIV prevalence among population aged 15-24 years
- 6.2 Condom use at last high-risk sex
- 6.3 Proportion of population aged 15-24 years with comprehensive correct knowledge of HIV/AIDS
- 6.4 Ratio of school attendance of orphans to school attendance of non-orphans aged 10-14 years

**Target 6.B: Achieve, by 2010, universal access to treatment for HIV/AIDS for all those who need it**

- 6.5 Proportion of population with advanced HIV infection with access to antiretroviral drugs

**Target 6.C: Have halted by 2015 and begun to reverse the incidence of malaria and other major diseases**

- 6.6 Incidence and death rates associated with malaria
- 6.7 Proportion of children under 5 sleeping under insecticide-treated bednets
- 6.8 Proportion of children under 5 with fever who are treated with appropriate anti-malarial drugs
- 6.9 Incidence, prevalence and death rates associated with tuberculosis
- 6.10 Proportion of tuberculosis cases detected and cured under directly observed treatment short course

**Goal 7: Ensure environmental sustainability**

**Target 7.A:** Integrate the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources

**Target 7.B:** Reduce biodiversity loss, achieving, by 2010, a significant reduction in the rate of loss

- 7.2 CO<sub>2</sub> emissions, total, per capita and per \$1 GDP (PPP)
- 7.3 Consumption of ozone-depleting substances
- 7.6 Proportion of terrestrial and marine areas protected
- 7.7 Proportion of species threatened with extinction

**Goal 8: Develop a global partnership for development**

**Target 8.A: Develop further an open, rule-based, predictable, non-discriminatory trading and financial system**

- Includes a commitment to good governance, development and poverty reduction - both nationally and internationally

**Target 8.B: Address the special needs of the least developed countries**

*Includes: tariff and quota free access for the least developed countries' exports; enhanced programme of debt relief for heavily indebted poor countries (HIPC) and cancellation of official bilateral debt; and more generous ODA for countries committed to poverty reduction*

**Target 8.C: Address the special needs of landlocked developing countries and small island developing States (through the Programme of Action for the Sustainable Development of Small Island Developing States and the outcome of the twenty-second special session of the General Assembly)**

**Target 8.D: Deal comprehensively with the debt problems of developing countries through national and international measures in order to make debt sustainable in the long term**

Some of the indicators listed below are monitored separately for the least developed countries (LDCs), Africa, landlocked developing countries and small island developing States.

Official development assistance (ODA)

- 8.1 Net ODA, total and to the least developed countries, as percentage of OECD/DAC donors' gross national income
- 8.2 Proportion of total bilateral, sector-allocable ODA of OECD/DAC donors to basic social services (basic education, primary health care, nutrition, safe water and sanitation)
- 8.3 Proportion of bilateral official development assistance of OECD/DAC donors that is untied
- 8.4 ODA received in landlocked developing countries as a proportion of their gross national incomes
- 8.5 ODA received in small island developing States as a proportion of their gross national incomes

Market access

- 8.6 Proportion of total developed country imports (by value and excluding arms) from developing countries and least developed countries, admitted free of duty
- 8.7 Average tariffs imposed by developed countries on agricultural products and textiles and clothing from developing countries
- 8.8 Agricultural support estimate for OECD countries as a percentage of their gross domestic product
- 8.9 Proportion of ODA provided to help build trade capacity

Debt sustainability

- 8.10 Total number of countries that have reached their HIPC decision points and number that have reached their HIPC completion points (cumulative)
- 8.11 Debt relief committed under HIPC and MDRI Initiatives
- 8.12 Debt service as a percentage of exports of goods and services

**Target 8.E: In cooperation with pharmaceutical companies, provide access to affordable essential drugs in developing countries**

- 8.13 Proportion of population with access to affordable essential drugs on a sustainable basis

**Target 8.F: In cooperation with the private sector, make available the benefits of new technologies, especially information and communications**

- 8.14 Fixed-telephone subscriptions per 100 inhabitants
- 8.15 Mobile-cellular subscriptions per 100 inhabitants
- 8.16 Internet users per 100 inhabitants

**SDGs**

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Source is <http://unstats.un.org/sdgs/news/> (From 10.19.2015 draft)

## CAADP

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**"Table: Relationship of Priority Indicators for CAADP Results Framework (2015-2025) to FSIN-TWG Phase 1 Report Indicators, SDG2, FAO's Food Security Indicators and Malabo Targets"**

## USAID - Food for Peace

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<http://www.fantaproject.org/sites/default/files/resources/FFP-Indicators-List-Apr2015.pdf>

R and RiA

- Prevalence of Poverty: Percent of people living on less than \$1.25/day
- Depth of Poverty: The mean percent shortfall relative to the \$1.25 poverty line
- Daily per capita expenditures (as a proxy for income) in USG-assisted areas
- Proportion of female participants in USG-assisted programs designed to increase access to productive economic resources (assets, credit, income or employment)
- Percentage of men and women who earned cash in the past 12 months
- Percentage of men/women in union and earning cash who make decisions alone about the use of self-earned cash
- Percentage of men/women in union and earning cash who make decisions jointly with spouse/partner about the use of self-earned cash
- Percentage of men and women with children under two who have knowledge of maternal and child health and nutrition (MCHN) practices
- Percentage of men/women in union with children under two who make maternal health and nutrition decisions alone
- Percentage of men/women in union with children under two who make maternal health and nutrition decisions jointly with spouse/partner
- Number of farmers and others who have applied improved technologies or management practices as a result of USG assistance
- Number of private enterprises, producers organizations, water users associations, women's groups, trade and business associations and community-based organizations (CBOs) that applied improved technologies or management practices as a result of USG assistance
- Number of individuals who have received USG supported short-term agricultural sector productivity or food security training
- Number of food security private enterprises (for profit), producers organizations, water users associations, women's groups, trade and business associations, and community-based organizations (CBOs) receiving USG assistance
- Number of people implementing risk- reducing practices/actions to improve resilience to climate change as a result of USG assistance



- Percentage of farmers who used at least [a project- defined minimum number of] sustainable agriculture (crop, livestock, and/or NRM) practices and/or technologies in the past 12 months
- Number of hectares under improved technologies or management practices as a result of USG assistance
- Value of incremental sales (collected at farm level) attributed to USG implementation
- Number of private enterprises, producers organizations, water users associations, women's groups, trade and business associations and community-based organizations (CBOs) that applied improved technologies or management practices as a result of USG assistance
- Number of people implementing risk- reducing practices/actions to improve resilience to climate change as a result of USG assistance
- Number of hectares under improved technologies or management practices as a result of USG assistance
- Value of incremental sales (collected at farm level) attributed to USG implementation
- Percentage of farmers who used improved storage practices in the past 12 months
- Total increase in installed storage capacity (m3)
- Number of market infrastructures rehabilitated and/or constructed
- Percentage of farmers who used financial services (savings, agricultural credit, and/or agricultural insurance) in the past 12 months
- Percentage of farmers who practiced the value chain activities promoted by the project in the past 12 months
- Value of Agricultural and Rural Loans
- Number of MSMEs, including farmers, receiving USG assistance to access loans
- Number of MSMEs, including farmers, receiving business development services from USG- assisted sources
- Number of MSMEs, including farmers, receiving FFP assistance to access savings programs
- Number of farmers who practiced the value chain activities promoted by the project
- Prevalence of households with moderate or severe hunger (Household Hunger Scale - HHS)
- Number of communities with disaster early warning and response (EWR) systems working effectively
- Number of people trained in disaster preparedness as a result of USG assistance
- Number of people benefiting from USG-supported social assistance programming
- Number of USG social assistance beneficiaries participating in productive safety nets
- Number of vulnerable households benefiting directly from USG assistance
- Number of rural households benefiting directly from USG interventions
- Percent of households in target areas practicing correct use of recommended household water treatment technologies
- Percent of households that can obtain drinking water in less than 30 minutes (round trip)

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- Percent of population in target areas practicing open defecation
- Percent of physically improved sanitation facilities with feces visibly present on the floor, wall, or area immediately surrounding the facility
- Number of people gaining access to an improved drinking water source
- Number of people gaining access to an improved sanitation facility
- Number of improved toilets provided in institutional settings
- Number of children under 2 (0-23 months old) participating in growth monitoring and promotion
- Contraceptive Prevalence Rate (CPR)
- Number of people trained in child health and nutrition through USG-supported programs
- Number of children under five reached by USG-supported nutrition programs
- Number of children under five years of age who received vitamin A from USG-supported programs
- Women's Dietary Diversity Score: Mean number of food groups consumed by women of reproductive age (WDDS)
- Number of additional USG- assisted community health workers (CHWs) providing family planning (FP) information and/or services during the year
- Women's Empowerment in Agriculture Index
- Percent of cases of acute malnutrition in children under 5 (6–59 months) detected who are referred for treatment
- Percent of villages in catchment area that hold to regular maintenance schedules for sanitation facilities
- Number of women receiving postpartum family planning counseling

## DFID

[https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/360906/DFID-external-results-Sep\\_2014.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/360906/DFID-external-results-Sep_2014.pdf); **Table 2a: DFID bilateral indicators**

DFID's results framework is organized into four levels that capture each main stage through which inputs are transformed into developing country results.

- Level 1 consists of indicators that represent development outcomes to which DFID is seeking to contribute in partner countries. These outcomes cannot be attributed to DFID alone; they result from the collective action of countries and diverse development partners.
  - Level 2 contains indicators measuring outputs and intermediate outcomes which can be directly linked to DFID interventions.
  - Level 3 contains indicators for monitoring DFID's operational effectiveness. Improvements at this level can lead to better delivery of results and greater value for money.
  - Level 4 indicators aim to monitor improvements in the efficiency of DFID's internal corporate processes to help improve capacity to provide more effective frontline delivery.
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- Level 2 indicators measure the outputs that can be directly linked to DFID programmes and projects – whether delivered through bilateral country programmes, or through contributions to multilateral organisations. The bilateral indicators were selected primarily through analysis of expected results set out in individual DFID country operational plans. They reflect those outputs where it is possible to aggregate results across different countries and so do not capture all the results that DFID is delivering. Multilateral indicators were selected from multilateral organizations' results frameworks.
  - DFID has developed methodological guidance on each bilateral indicator to help ensure consistency of measurement across countries and permit meaningful aggregation of results. Which is available here: <https://www.gov.uk/government/publications/indicator-methodology-notes>.
  - There are 22 DFID bilateral results indicators based on nine pillars – 1. Wealth Creation (2 results indicators) 2. Poverty, Vulnerability, Nutrition & Hunger (3 results indicators) 3. Education (2 results indicators) 4. Malaria (2 results indicators) 5. Reproductive, Maternal and Neo-Natal Health (4 results indicators) 6. Water and Sanitation (WASH) (1 result indicator combining three indicators) 7. Humanitarian and Emergency Response (1 result indicator) 8. Governance and security (4 results indicators) and 9. Climate Change (3 results indicators).
  - Number of people with access to financial services as a result of DFID support, Number of children under five, breastfeeding and pregnant women reached through DFID's nutrition relevant programmes, Number of additional women using modern methods of family planning through DFID support, and Number of unique people reached with one or more water, sanitation or hygiene promotion intervention (This combines three indicators: Number of people with sustainable access to clean drinking water sources with DFID support, Number of people with sustainable access to an improved sanitation facility through DFID support, Number of people with access to improved hygiene through DFID support to hygiene promotion) -- these results will be delivered through both bilateral and multilateral delivery channels.

- Number of people achieving food security through DFID support -- the results commitment for the number of people achieving food security through DFID support is based on reaching 3 million people with full food security, and 1 million people with emergency food assistance.
- Number of children supported by DFID in primary and lower secondary education -- The reporting of the results commitment for the number of children supported by DFID in education has been simplified from previous years, and now presents a single figure for all children in primary and lower secondary education.
- Number of malaria specific deaths per 100,000 persons per year, Number of maternal lives saved through DFID support and Number of neonatal lives saved through DFID support -- modelled indicators require an internationally agreed methodology to measure performance. For Malaria, the World Health Organization (WHO) has established an Evidence Review Group on Malaria Burden Estimation Methodology and is working to implement its recommendations and publish estimates with a revised methodology in the World Malaria Report 2014.
- Water and Sanitation (WASH) -- A new public commitment has been made on water, sanitation and hygiene (WASH) (60 million). This supersedes three separate targets. Measurement of the new WASH commitment requires the results of three separate indicators to be combined to determine the total number of unique people reached with one or more of these interventions. The results of each individual indicator will continue to be published to ensure full transparency and accountability for delivery of results.
- The results commitments are to be delivered in 2015. For the majority of commitments, the end date relates to March 2015 to align with the 2014/15 financial year, with the exception of the WASH, nutrition, maternal and neonatal lives saved commitments which relate to December 2015.
- Eight of DFID's Level 2 Results Framework Indicators are sex disaggregated and are used to measure progress against the results outlined within DFID's *Strategic Vision for Girls and Women*. This has been reduced from nine, following the simplification of the reporting of the results commitment for children supported in education. These are:
  - Number of people with access to financial services as a result of DFID support
  - Number of people supported through DFID to improve their rights to land and property
  - Number of children supported by DFID in primary and lower secondary education
  - Number of children completing primary education supported by DFID
  - Number of births delivered with the help of nurses, midwives or doctors through DFID support
  - Number of additional women using modern methods of family planning through DFID support
  - Number of maternal lives saved through DFID support
  - Number of women and girls with improved access to security and justice services through DFID support

In addition, all other relevant indicators are sex-disaggregated wherever feasible and age and poverty breakdowns will be provided for the family planning indicator where appropriate.

**Institutions not listed:**

**UNICEF** maintains this database: <http://data.unicef.org/nutrition/malnutrition.html> from data shared with WHO and World Bank. It's indicators and definitions:

- Severe Wasting: Percentage of children aged 0–59 months who are below minus three standard deviations from median weight-for-height of the WHO Child Growth Standards.
- Wasting – Moderate and severe: Percentage of children aged 0–59 months who are below minus two standard deviations from median weight-for-height of the WHO Child Growth Standards.
- Overweight – Moderate and severe: Percentage of children aged 0–59 months who are above two standard deviations from median weight-for-height of the WHO Child Growth Standards.
- Stunting – Moderate and severe: Percentage of children aged 0–59 months who are below minus two standard deviations from median height-for-age of the WHO Child Growth Standards.
- Underweight – Moderate and severe: Percentage of children aged 0–59 months who are below minus two standard deviations from median weight-for-age of the World Health Organization (WHO) Child Growth Standards.

**Gates Foundation:** Contributes discussion paper to conversation around development of SDG indicators

<https://docs.gatesfoundation.org/documents/Post%202015%20Food%20Security%20Discussion%20Paper.pdf>

**UNESCO:** Education / Science, Technology, and Innovation / Culture / Communication and Information / Demographic & Socio-economic

**UNDP:** refers to the WHO indicators

**WFP:** <https://resources.vam.wfp.org/Food-Security-Indicators> (from 2011)

## Acronyms

ADePT-FSM	ADePT-Food Security Module
ADER	Average Dietary Energy Requirement
ADESA	Average Dietary Energy Supply Adequacy
AMIS	Agricultural Market Information System
AOI	Agriculture Orientation Index
BF	Breastfeeding
BFP	Body Fat Percentage
BMI	Body Mass Index
CDC	Centers for Disease Control and Prevention
CFSAM	Crop and Food Security Assessment Mission
CFSVA	Comprehensive Food Security and Vulnerability Analysis
CILSS	Comité permanent Inter-États de Lutte contre la Sécheresse dans le Sahel (Permanent Interstate Committee for Drought Control in the Sahel)
CSI	Coping Strategies Index
CV	Coefficient of Variation
DALYs	Disability Adjusted Life Years
DHS	Demographic and Health Surveys
dL	Decilitre
DQI-I	Diet Quality Index-International
DRMFSS	Disaster Risk Management and Food Security Sector
EAP	Expert Advisory Panel
EBF	Exclusive Breastfeeding
EFSA	Emergency Food Security Assessment
ELBW	Extremely Low Birth Weight
EMPRES	Emergency Prevention System
FANTA	Food and Nutrition Technical Assistance
FAO	Food and Agriculture Organization
FBS	Food Balance Sheet
FCS	Food Consumption Score
FEWS NET	Famine Early Warning Systems Network
FIES	Food Insecurity Experience Scale
FSCCP	Food Security Commitment and Capacity Profile
FSIEWS	Food Security Information and Early Warning System
FSIN	Food Security Information Network
FSMS	Food Security Monitoring System
FSNM	Food Security and Nutrition Monitoring

GDP	Gross Domestic Product
GEA	Government Expenditures on Agriculture, Forestry and Fishing
GFSI	Global Food Security Index
GFSM	Government Finance Statistics Manual
GHI	Global Hunger Index
GIEWS	Global Information and Early Warning System on Food and Agriculture
GNR	Global Nutrition Report
GREP	Global Rinderpest Eradication Programme
HANCI	Hunger and Nutrition Commitment Index
HAZ	Height-for-Age Z scores
Hb	Hemoglobin
HCES	Household Consumption and Expenditure Surveys
Hct	Hematocrit
HDDS	Household Dietary Diversity Score
HEI	Healthy Eating Index
HES	Household Expenditure Survey
HFIAS	Household Food Insecurity Access Scale
HHI-PD	Hidden Hunger Index based on the Prevalence Estimates
HHS	Household Hunger Scale
HRD	Humanitarian Requirements Document
IAEG	Inter-Agency Expert Group
IAEG-SDGs	Inter-Agency Expert Group on Sustainable Development Goal Indicators
ICP	International Comparison Program
IDS	Institute of Development Studies
IEG	Independent Evaluation Group
IFPRI	International Food Policy Research Institute
ILO	International Labour Organization
IMF	International Monetary Fund
IPC	Integrated Food Security Phase Classification
IYC	Infant and Young Child
IYC DDS	Infant and Young Child Dietary Diversity Score
IYC MAD	Infant and Young Child Minimum Acceptable Diet
JAM	Joint Assessment Mission
Kcal	Kilocalorie
Kg	Kilogram
LBW	Low Birth Weight
LSMS	Living Standards Measurement Study
M&E	Monitoring and Evaluation



MAM	Moderate Acute Malnutrition
MDD	Minimum Dietary Diversity
MDD-W	Minimum Dietary Diversity-Women
MDER	Minimum Dietary Energy Requirement
MDGs	Millennium Development Goals
MFAD	Modified Functional Attribute Diversity
MLDD	Market Level Diet Diversity
MUAC	Mid-Upper Arm Circumference
NCDs	Non Communicable Diseases
NHANES	National Health and Nutrition Examination Surveys
OECD	Organisation for Economic Co-operation and Development
OIE	World Organisation for Animal Health
Pct	Percentage
PEM	Protein-Energy Malnutrition
PoU	Prevalence of Undernourishment
PPP	Purchasing Power Parity
PSD	Production, Supply and Distribution
RP	Rinderpest
SAM	Severe Acute Malnutrition
SDGs	Sustainable Development Goals
SES	Socio-Economic Status
SOFI	State of Food Insecurity
SSA	Sub-Saharan Africa
SUN	Scaling Up Nutrition
TWG	Technical Working Group
UN	United Nations
UNHCR	United Nations High Commissioner for Refugees
UNICEF	United Nations Children's Fund
UNSC	United Nations Statistical Commission
USA	United States of America
USDA	United States Department of Agriculture
VAD	Vitamin A Deficiency
VAM	Vulnerability Analysis and Mapping
VLBW	Very Low Birth Weight
W/A	Weight-for-Age
W/H	Waist measurement divided by Hip measurement
WASH	Water, Sanitation and Hygiene
WAZ	Weight-for-Age Z-scores
WB	World Bank
WFP	World Food Programme

WFS	World Food Summit
WHA	World Health Assembly
WHO	World Health Organization
WHR	Waist-to-Hip Ratio
WHZ	Weight-for-Height Z-scores

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