



**START CENTER**  
STRATEGIC ANALYSIS,  
RESEARCH & TRAINING CENTER

## NUTRITION DAE SUMMARY REPORT

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UNIVERSITY OF WASHINGTON STRATEGIC ANALYSIS, RESEARCH & TRAINING (START) CENTER

REPORT TO THE BILL AND MELINDA GATES FOUNDATION

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## INTRODUCTION

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An estimated 3.1 million deaths in children under 5 years of age are attributable to undernutrition globally each year. The World Health Organization (WHO) estimates that there will be 128 million stunted children and no change in low birthweight rates by 2025 – falling well short of World Health Assembly goals (1). A key component of achieving success in global nutrition will be ensuring countries have access to valid and timely nutrition data. A major work stream of the Data, Analytics, and Evidence (DAE) initiative of the Nutrition Strategy at the Bill and Melinda Gates Foundation (BMGF) is to strengthen country data and information systems. The BMGF DAE work stream sought support from the START Center to achieve the following objectives:

1. Conduct a detailed review and comparison of nutrition data collected in commonly used household survey tools,
2. Review the published and grey literature for description of the inclusion of nutrition data in country-owned health management information systems (HMIS) with a specific focus on the DHIS2 platform,
3. Review global databases of nutrition data and provide a summary of nutrition data included, database functionality, data sources, and data quality.

The following report details the START (Strategic Analysis, Research & Training) Center’s approach and results regarding these objectives.

## METHODOLOGY

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### OBJECTIVE 1: SUMMARY OF HOUSEHOLD SURVEY NUTRITION TOOLS

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The START team reviewed the Demographic Health Surveys (DHS), Multiple Indicator Cluster Surveys (MICS), Living Standard Measurement Study (LSMS), and the Standardized Monitoring and Assessment of Relief and Transitions (SMART) surveys for inclusion in this objective. The SMART surveys were omitted from in-depth indicator analysis because they were merely a component of the SMART methodology; data collected from SMART surveys are not reported back to SMART nor are they stored in a central location. The LSMS surveys were also omitted from in-depth indicator analyses due to their limited nutrition scope, frequent departures from standardization, and sparse availability of recent survey data. Major features of SMART and LSMS surveys are briefly described in the Survey Information tab of the Nutrition DAE Summary Workbook Excel file.

The team systematically reviewed publicly available information regarding the design, questionnaires, analytic techniques, and data reported for both DHS and MICS surveys (2–6). After consultation from the BMGF DAE team, the START Center established 5 key domains of indicator inclusion – *Diet Quality and Feeding Practices, Anthropometry, Micronutrients, Care Seeking, and WASH* (water, sanitation, and hygiene). Next, the complete list of indicators collected by each survey was reviewed for inclusion by classifying them into the aforementioned domains. For each indicator, the START team compiled the survey question, population of interest, as well as numerator and denominator data for each included indicator. Following this, assessments were made regarding the comparability between surveys for each indicator, including both measurement and reporting differences. Actual survey results from Nigeria from a MICS published in 2011 and DHS in 2013 were included as a point of reference to provide



potential context. All of these components were arranged into a filterable table in the Nutrition DAE Summary Workbook Excel file.

Several indicators specified in the Nutrition DAE Dashboard were not included in either survey. These, as well as a handful of other indicators that are commonly reported in the literature or have expert consensus as being relevant to nutritional status, are annotated separately within the Nutrition DAE Summary Workbook Excel file. A corresponding reference is provided for each of these unmeasured indicators. The DAE's Nutrition Dashboard indicators that were not found in either survey were also included in the section with other unmeasured indicators and labeled as such.

## OBJECTIVE 2: REVIEW OF HMIS NUTRITION INDICATORS

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The first task for completion of this objective was to review the published literature for articles describing the use of nutrition indicators in HMIS. One branded system, District Health Information System 2 (DHIS2), was singled out as being of particular interest due to its widespread use, user-friendliness and customization features. The following search terms were used in PubMed: “health management information system(s)”, “hmis”, “district health information system”, “dhis”, and “nutrition”. A snowball literature search through gray literature was also conducted.

Key informant interviews were arranged with individuals who had DHIS2 experience in-country. Case study countries included focus countries of interest to the BMGF, as well as Kenya, which is not a focus country, but serves as a good example given DHIS2 is adopted nationally and routinely collects nutrition data. The semi-structured interviews were arranged to discuss the following elements: *to what extent are nutrition indicators collected in HMIS, how are data commonly collected, what data quality processes are in place, and challenges in the collection of nutrition data*. The following organizations participated in interviews: UNICEF secondees to the Kenyan Ministry of Health, a project manager at DiMagi, and the Managing Director of Systems Innovations for Global Health Technology (SIGHT) at I-TECH. Themes and findings were then summarized and presented in this report.

## OBJECTIVE 3: REVIEW OF GLOBAL NUTRITION DATABASES

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The START team reviewed 14 publicly available, web-based, global nutrition databases. For each database the team provides commentary on user-friendliness and accessibility, and presents a summary of content and key features including: managing organization (e.g., World Health Organization), purpose of the database, data source(s), geographic coverage, populations covered, nutrition indicators included, and notes on data quality, available documentation, features of use, and whether they are no longer updated, currently in use, or under construction.



## RESULTS

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### OBJECTIVE 1

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#### SUMMARY OF HOUSEHOLD SURVEYS

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**DHS** The Demographic Health Surveys (DHS) was first implemented in 1985, and has since been used in over 90 countries. The DHS is a stratified two-stage cluster household survey intended to be nationally representative, and sometimes powered to be representative at a sub-national level. The DHS captures a plethora of information on households including demographics, awareness of healthy behaviors, and nutritional status. Specific measurements are made at the individual level (e.g., anthropometric measurements), and the household level (e.g., availability of iodized salt). DHS documentation, reports, data, and other tools can be found at <http://dhsprogram.com/>.

**MICS** The Multiple Indicator Cluster Surveys (MICS) design has been active since 1995. Currently MICS is in its sixth round and has been implemented in over 100 countries. MICS is a cluster-randomized household survey that is most often conducted at the national level. Occasionally countries have implemented a MICS on a restricted sub-set of administrative units in a country (e.g., Mexico City). The MICS aims to assess health, nutrition, education, and protection status of primarily women and children. Specific measurements are made at the individual level (e.g., anthropometric measurements), and the household level (e.g., availability of iodized salt). Documentation, guidance materials, reports, and data can be found at <http://mics.unicef.org/surveys>.

**SMART** Standardized Monitoring and Assessment of Relief and Transitions (SMART) is an interagency (i.e., humanitarian organizations, USAID, etc.) collaboration that was established in 2002. Unlike the DHS and MICS, the purpose of SMART is to provide survey methodology that governments and NGOs can implement to rapidly attain accurate estimates of mortality rates and nutritional status of children under 5 years of age in emergency situations and humanitarian crises. The SMART Methodology Manual provides guidance on the collection of anthropometric measures to estimate prevalence of acute malnutrition in children aged 6–59 months (including severe acute malnutrition, global acute malnutrition, stunting [low height-for-age], wasting [low weight-for-height], etc.) and mid-upper arm circumference, and suggests collection of other measures such as micronutrient status, nutrition program coverage, and food security (7). In addition to standardized survey methodology, SMART recommends using their free downloadable Emergency Nutrition Assessment (ENA) software to help design and implement surveys. In response to SMART, the Centre for Research on the Epidemiology of Disasters at the Catholic University of Louvain created the [Complex Emergency Database \(CEDAT\)](#), a repository of SMART survey data (8). According to their website, CEDAT has collected 3,432 surveys. Unfortunately, CEDAT no longer makes their database publicly available. In addition to implementation during emergency situations, the SMART methodology has been applied to assess progress on nutrition indicators between DHS and MICS (e.g., National Nutrition and Health Survey in Nigeria (9)). SMART guidance materials and software can be found at <http://smartmethodology.org/>.

**LSMS** The World Bank has been sponsoring the Living Standard Measurement Study (LSMS) since the early 1980s. It is a two-stage cluster survey capturing data on household food expenditures, agro-pastoral activities, and the price of food. More recently, the World Bank in collaboration with BMGF have established the Integrated Surveys on Agriculture (LSMS-ISA); which further aims to elucidate the links between agriculture, socioeconomic status, and non-farm income. These have been primarily



focused in sub-Saharan Africa. Since 2010, 24 surveys have been administered in 12 countries, including a 2014 survey in Burkina Faso, four surveys in Ethiopia, and three in Nigeria. Further details on the LSMS, LSMS-ISA, and supporting documents can be found [here](#)<sup>1</sup>.

A more detailed summary of these surveys can be found in the Survey Information tab of the Nutrition DAE Summary Workbook Excel file.

## COUNTRY-SPECIFIC SURVEYS

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### *Bangladesh*

**UESD** The Utilization of Essential Service Delivery (UESD) Survey was created for the purposes of monitoring progress on the Health, Population and Nutrition Sector Development Programme over a five year period (July 2011 to June 2016). These surveys were implemented during the years between the DHS and collected data on stunting, underweight, vitamin A supplementation, exclusive breastfeeding, appropriate infant and young child feeding practices, among other indicators. The sampling methodology is similar to the DHS (10,11).

**FSNS** Funded by the National Nutrition Services (NNS), the Food Security and Nutrition Surveillance-National Nutrition Services (FSNS-NNS) project measures the nutritional status and health care among children and women in Bangladesh. Nutrition and health data are collected and reported three times a year. An annual report is also produced. FSNS has been operating since 2010 (12,13).

### *Nigeria*

**NNHS** The National Nutrition and Health Survey (NNHS) is an annual household survey carried out by the National Bureau of Statistics in Nigeria. Along with DHS and MICS, it is administered to aid in monitoring programs on a regular basis. The NNHS draws on the SMART methodology and measures malnutrition, MUAC, coverage of vitamin A supplementation, and other health indicators (14).

## TIMELINE OF SURVEYS IN BMGF PRIORITY COUNTRIES

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A timeline of DHS and MICS surveys conducted between 2010 and 2016 within the BMGF priority countries for nutrition—Bangladesh, Burkina Faso, Ethiopia, India, and Nigeria—was compiled to illustrate years of overlap (Table 1). Bangladesh and Nigeria were the only two priority countries where DHS and MICS data-collection windows overlapped. The National Family Health Survey (NFHS) of India is managed by the Government of India, with technical assistance provided by USAID and BMGF. LSMS and other country-specific nutrition surveys conducted during this time period are also provided in the timeline.

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<sup>1</sup><http://econ.worldbank.org/WBSITE/EXTERNAL/EXTDEC/EXTRESEARCH/EXTLSMS/0,,contentMDK:23506656~pagePK:64168445~piPK:64168309~theSitePK:3358997,00.html>



**Table 1.** Co-Occurrence of Surveys with Nutrition Indicators in BMGF Nutrition Priority Countries Since 2010

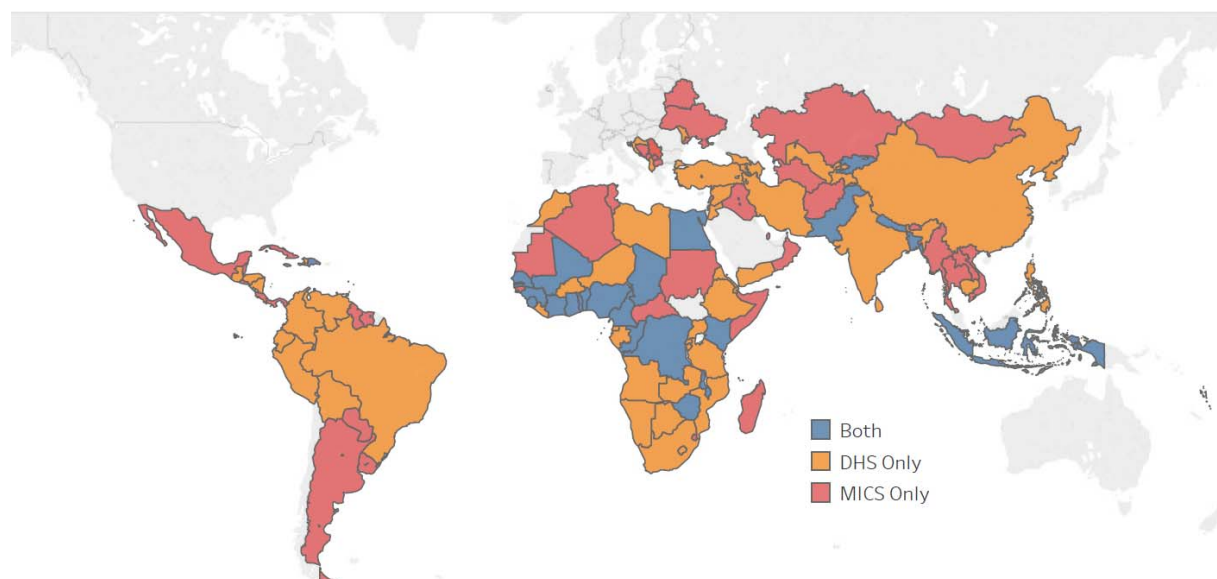
	2010	2011	2012	2013	2014	2015	2016
Bangladesh							
DHS	DHS 2011				DHS 2014		
MICS	MICS 5						
LSMS							
UESD	UESD 2010			UESD 2013			UESD 2016
FSNS	FSNS 2010	FSNS 2011	FSNS 2012	FSNS 2013	FSNS 2014	FSNS 2015	
Burkina Faso							
DHS	DHS 2010						
MICS							
LSMS				LSMS 2014			
ENN	ENN 2010	ENN 2011	ENN 2012	ENN 2013	ENN 2014	ENN 2015	ENN 2016
Ethiopia							
DHS	DHS 2011						
MICS							
LSMS	LSMS 2012			LSMS 2013		LSMS 2015	
India							
NFHS							NFHS 15-16
MICS							
LSMS							
Nigeria							
DHS	DHS 2013						
MICS	MICS 4						
LSMS	LSMS 2010		LSMS 2012		LSMS 2015		
NNHS				NNHS 2014		NNHS 2015	

Abbreviations: DHS, Demographic and Health Survey; MICS, Multiple Indicator Cluster Survey; LSMS, Living Standard Measurement Study; UESD, Utilization of Essential Service Delivery; FSNS, Food Security and Nutrition Surveillance; ENN, Enquête Nutritionnelle Nationale (National Nutrition Survey); NFHS, National Family Health Survey; NNHS, National Nutrition and Health Survey

## COMPARISON OF DHS AND MICS SURVEYS

The DHS and MICS are most comparable of the large multinational surveys in terms of purpose, regularity, target population, and information gathered. Therefore, these are the focus of the detailed synthesis in this report. Since 2010, MICS and DHS have both occurred in 24 countries (Figure 1).

**Figure 1.** Geographic Co-Occurrence of DHS and MICS Surveys Since 2010



## SUMMARY OF HOUSEHOLD NUTRITION INDICATORS

A review of DHS and MICS questionnaires and reports identified a total of 62 nutrition-related indicators for consideration. Of these, there were 41 indicators that were collected in both surveys (Table 2). The *Diet Quality & Feeding Practices* and *Care Seeking* domains included the most nutrition indicators (18 each). *Diet Quality & Feeding Practices*, *Care Seeking*, and *WASH* domains had the most overlap between surveys, with 89% (16/18), 83% (15/18), and 75% (3/4) of indicators being shared, respectively. *Micronutrients* had the least overlap, with MICS only capturing data on Vitamin A supplementation and household availability of iodized salt.

**Table 2.** Summary of Nutrition-Related Indicators by Domain and Survey

	Total Nutrition Indicators Collected between DHS/MICS	Individual nutrition indicators collected in DHS	Individual nutrition indicators collected in MICS	Overlapping indicators between surveys
Diet Quality & Feeding Practices	18	18	16	16
Anthropometry	9	9	4	4
Micronutrients	13	13	2	2
Care-Seeking	18	17	15	15
WASH	4	3	4	3
<b>Total</b>	<b>62</b>	<b>60</b>	<b>41</b>	<b>41</b>

**DHS-MICS Indicator Comparison** The supplementary Microsoft Excel file ‘Nutrition DAE Summary Workbook,’ tabs 3–7, which are shaded green provide a side-by-side comparison of the MICS and DHS nutrition indicators. Each domain has its own tab. MICS indicators are denoted in white rows and DHS indicators are denoted in light blue rows. For each indicator, the following are provided:

- **Generic Indicator:** Descriptive name of each indicator (e.g., Early initiation of breastfeeding).
- **Indicator by Survey:** Unique name of indicator as stated in survey.
- **Measurement Notes (Anthropometric domain only):** Method of measurement intended for anthropometric indicators.
- **Measurement Differences:** Any differences in assessment between the two surveys are noted here, such as population of interest, question syntax, numerator, denominator, etc.
- **Population of Interest:** Intended population to be relevant for the question (e.g., children under 5 years of age).
- **Numerator:** The value intended to go in the numerator of a calculation of a percentage.
- **Denominator:** The value used in the denominator of a calculation of a percentage. Note that this may be further restricted beyond the population of interest (e.g., children under 5 who are not breastfed).
- **Survey Results - Nigeria:** Survey results from Nigeria are provided for MICS 2011 and DHS 2013.
- **Reporting Differences:** Differences in how data were reported in surveys. Typically, this is in the form of disaggregation (e.g., age bands, sex, sub-national unit).
- **Other Comments:** Narrative comments are provided by the START team, which explain nuances in either how indicators are collected, measured, or reported.



## ILLUSTRATIVE EXAMPLES

There is much overlap between DHS and MICS, but there are also subtle differences between the surveys in how questions are asked, denominators are defined, and how data are disaggregated. Examples of these differences and how they can affect final data summaries are provided below.

### *Milk Feeding Frequency for Non-Breastfed Children*

Both the MICS and DHS indicators are described as “Percentage of non-breastfed children age 6–23 months who received at least 2 milk feedings during the previous day”. While seemingly comparable, the way in which the question is asked differs by survey. For instance, the MICS asks the interviewee to list everything that the child consumed in the prior 24 hours. The DHS asks explicitly “How many times did (NAME) drink milk?”. In the former, it would be incumbent upon the interviewee to recall the milk feeding and the frequency in order to be registered for this indicator, while the latter is far more explicit. The survey results are considerably different for Nigeria MICS 2011 and DHS 2013 at 30.1% and 16.4%, respectively (Figure 2) (6,15).

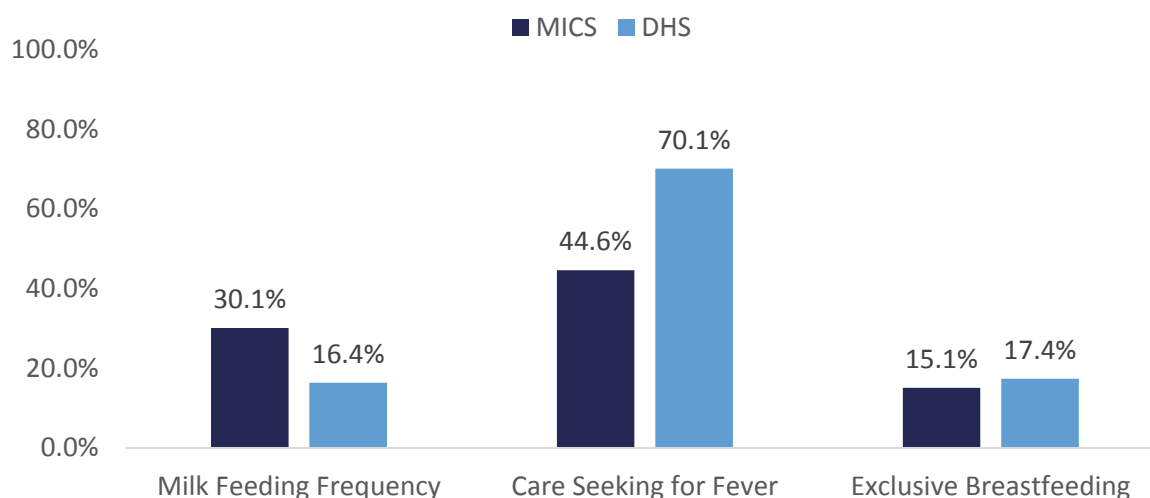
### *Care Seeking for Fever*

The questions for this indicator are nearly identical between surveys: “Did you seek advice or treatment for the illness from any source?”. This question is also posed to the same population of interest, children under 5 years of age. Given this, one might expect the survey results to be similar; however, we find a remarkable difference with Nigeria MICS 2011 finding this 44.6% of the time and DHS 2013 at 70.1% (Figure 2). While the differences in these findings are unclear, there are certainly external factors that could affect these figures. For example, periodicity of interview may affect the underlying frequency of fever and likelihood to seek care (i.e., malaria season) (6,15).

### *Exclusive Breastfeeding*

Exclusive breastfeeding questions and populations of interest are very similar between surveys. This is well reflected in the similar statistics for the Nigeria MICS 2011 and DHS 2013 of 15.1% and 17.4%, respectively (Figure 2) (6,15).

**Figure 2.** Illustrative Examples of the Similarities and Differences Between MICS 2011 and DHS 2013 Results from Nigeria for Select Indicators



## OTHER RELEVANT INDICATORS

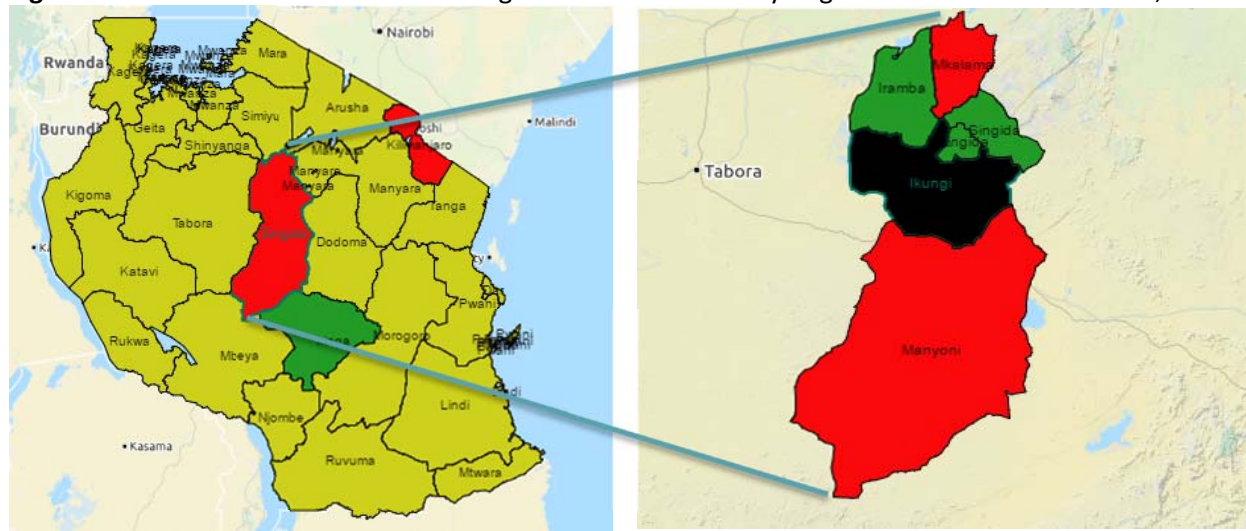
At the end of each worksheet in the Nutrition DAE Summary Workbook, a list of additional nutrition indicators is presented that are not measured in either the DHS or MICS surveys. These are indicators that are included in the Nutrition DAE Dashboard, as well as a number that have general consensus by nutrition experts to be relevant with a strong evidence base. These indicators are highlighted in peach in the Nutrition DAE Summary Workbook. Along with each of these, we provide a reference justifying the measure's consideration as a potentially important nutrition indicator or measure of nutrition intervention coverage. A total of 27 unmeasured indicators are listed, a notable subset includes: receipt of breastfeeding counseling and support, formula milk consumption, middle-upper arm circumference (MUAC), folic acid supplementation/intake, and prevalence of hand-washing at critical periods.

## OBJECTIVE 2

### SUMMARY OF DHIS2

The District Health Information System 2 (DHIS2) is an open source, web-based platform for the management and visualization of data. The system is accessible on mobile devices, has off-line capabilities, and can allow for customizable graphs and maps. The system is typically used for aggregate facility and/or community data, and is health sector wide – including nutrition. Data stored in DHIS2 may be descriptive (e.g., percentage of low birthweight infants) or programmatic (e.g., number of persons receiving Vitamin A supplementation). It is not typical at this time for DHIS2 to contain individual, case-based data as would be managed in an electronic medical record (EMR) (e.g., Person A's height, weight, and blood pressure). Rather, the system allows for aggregation or disaggregation of information from site, to sub-district, to district, to province, to national levels. The host website provides more information as well as access to demo data, and can be found at <https://www.dhis2.org/>. Figure 3 is an example of aggregate nutrition data in map format produced by Tanzania's publicly available DHIS2 interface.

**Figure 3.** Occurrence of Severe Underweight Children Under 5 by Region and District in Tanzania, 2016



## CASE STUDY - BANGLADESH

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### *Background*

Bangladesh has made large investments to improve the management of their health information, though this effort has largely been implemented in small-scale fragments within the many health entities under the Ministry of Health and Family Welfare (MOHFW). MOHFW is divided into two main divisions, the Directorate General of Health Services (DGHS) and the Directorate General of Family Planning (DGFP), which both implement nutrition services. DGHS uses DHIS2 as their primary health information management system. Current efforts are being made to either shift to reporting directly into DHIS2 or link existing health information systems to DHIS2 to streamline health information management and reporting systems across MOHFW implementing entities (16,17).

### *Nutrition Indicators and their Collection*

With the expansion of the Integrated Management of Childhood Illness (IMCI) Corner to include nutrition services, the IMCI and Nutrition Corner collects and reports community clinic nutrition indicators on a monthly basis (18). Ten nutrition indicators are reported, including anemia, low birth weight (within 72 hours of birth), breastfeed within 1 hour of birth, exclusive breastfeeding, complementary feeding, underweight, stunting, wasting, severe acute malnutrition, moderate acute malnutrition. An additional counseling indicator is reported for infant and young child feeding, vitamin A, anemia, etc. In addition to these aggregated indicators, DHIS2 has also been used as a “patient tracker” to monitor pregnant women and children under five years.

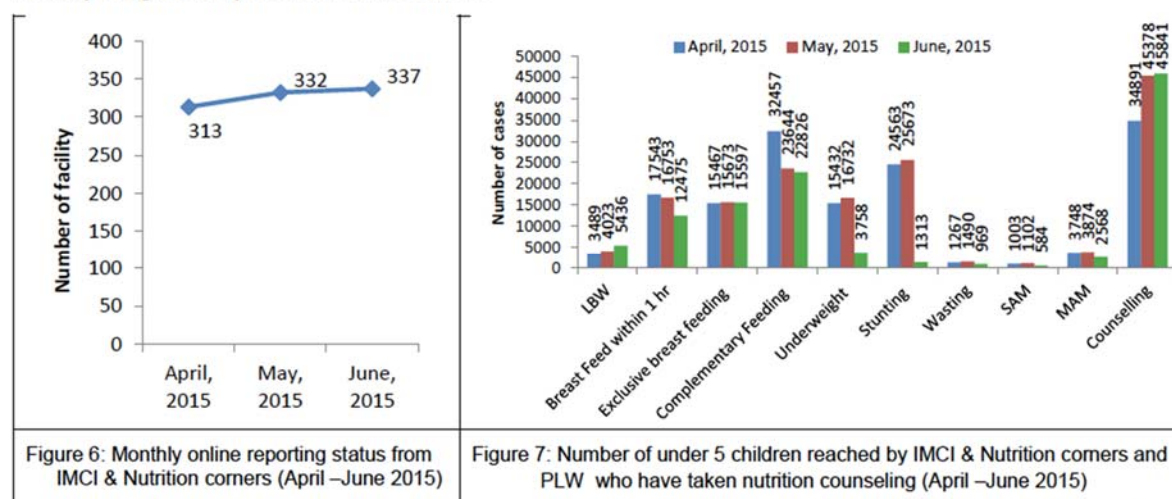
### *Data Governance, Use, and Limitations*

While 13,000 community clinics have been reported to submit monthly aggregated reports through DHIS2, its use to aggregate and streamline data is still in development across health entities. According to a mapping analysis conducted by the Systems for Improved Access to Pharmaceutical and Services (SIAPS) Program in 2015, as more data sets are added to DHIS2 there will be a greater need for data quality control efforts. They also recommended eliminating the “patient tracker” component from DHIS2 as it is not equipped to hold individual level data (17).

Quarterly newsletters from the National Nutrition Services report back data entered into DHIS2. Figure 4 shows the number of facilities submitting monthly updates from IMCI and Nutrition Corners and the number of cases reported for ten nutrition indicators in the July 2015 newsletter (19). A review of the National Nutrition Services found limitations in the collection of standardized nutrition indicators via the IMCI and Nutrition Corner. For instance, low birth weight may be subject to recall bias and selection bias as few neonates with low birth weight are likely to attend IMCI and Nutrition Corner. They recommend a reassessment of standardized nutrition indicators given the limitation of data collection methods (20).



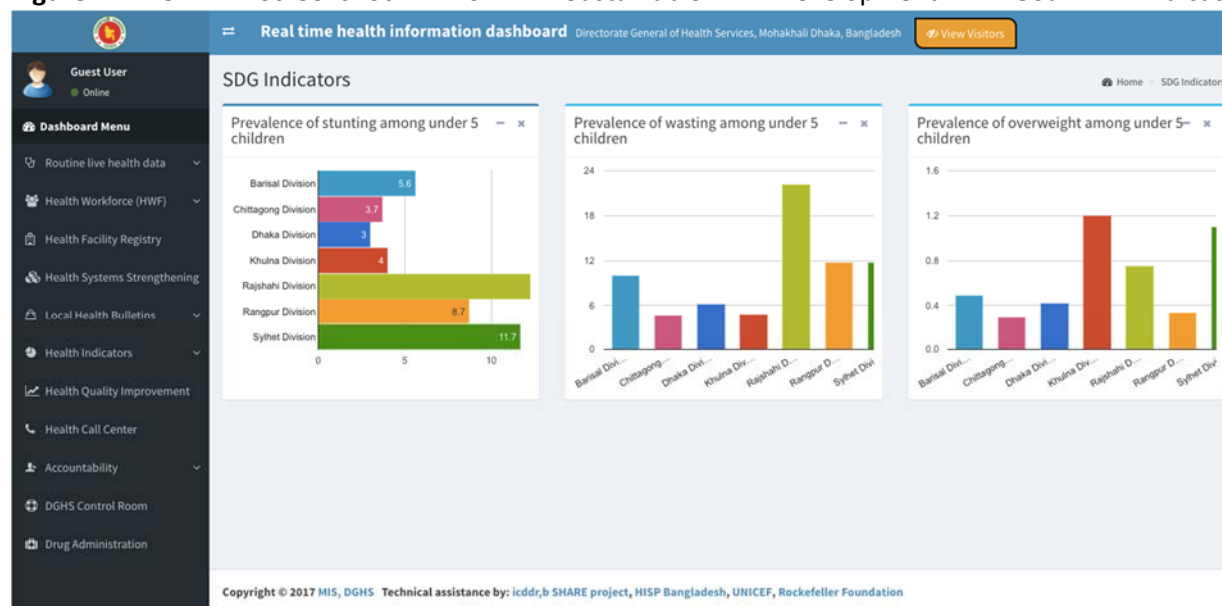
**Figure 4.** Screenshot of the National Nutrition Services Newsletter, Issue #5, July 2015  
**Monthly Progress Report On IMCI-N Corners**



Source: Online HMIS, MIS-DGHS

DHIS2's publicly accessible dashboard displays division level results for the Sustainable Development Goal indicators of prevalence of stunting, wasting, and overweight (Figure 5). Exclusive breastfeeding using a combo chart is reported countrywide across time. Currently, there are no customizable capabilities on the publicly accessible dashboard.

**Figure 5.** Screenshot of Sustainable Development Goal Indicators



## CASE STUDY - KENYA

### Background

Kenya is currently using an instance of DHIS2 as its system of record for routine surveillance health-sector wide – including their nutrition program. There are a number of other electronic health information systems in use throughout the country, including hospital- and clinic-based electronic



medical records and platforms that further support other health programs; many of these are managed by other entities (partner organizations), and some supplement the nutrition data in DHIS2. Additional information systems are currently being used to maintain nutrition data collected by household surveys (other than DHS and MICS), micronutrient surveys, and sentinel surveillance.

#### *Nutrition Indicators and their Collection*

A total of 11 nutrition indicators are maintained in the Kenyan DHIS2; however, these comprise 50-60 data elements when including all of the related disaggregates. The nutrition indicators are: underweight, stunting, vitamin A supplementation in children, iron and folate supplementation for pregnant women, treatment of severe acute malnutrition, treatment of moderate acute malnutrition, de-worming for children, average number of weightings per child, early initiation of breastfeeding, exclusive breastfeeding, and children receiving micronutrient powders. In addition to these indicators, DHIS2 is used to also track the consumption and receipt of nutrition commodities. Note that WASH information is kept in DHIS2, but is not currently maintained in the nutrition module.

Data are aggregated at the facility level, most commonly originating from paper records. Only the largest facilities or referral hospitals may have electronic systems, and still are required to manually transfer those data to DHIS2. Data are expected to be entered in DHIS2 monthly by each site. Some community data are held in DHIS2. However, this is restricted to community interventions that are operated from a physical site. Typically, data from mass campaigns are not included in DHIS2 due to concerns over double counting.

#### *Data Governance, Use, and Limitations*

The use of DHIS2 to maintain national nutrition data was preceded by a well-defined system of routine surveillance. In that regard, DHIS2 can be considered the next step in the evolution of an existing system. This system includes the government-led Nutrition Information Technical Working Group, the Emergency Nutrition Advisory Committee, and other structures by which government officials and external stakeholders may contribute to capacity building, analytics, and enhancement of nutrition information in country. These are the channels by which new nutrition indicators are considered for future reporting, training is provided to facility staff, and data are explored for interpretation and use.

A primary limitation to both data quality and overall implementation is the lack of capacity, health worker bandwidth, and dedicated data entry staff. In spite of these limitations, Kenya has routine training and continuous data quality assurance efforts. The government has also sought external assessment of their system from the U.S. government.

Even with these limitations, DHIS2 is the most commonly used source of data due to it maintaining the most up to date data available. This use includes the tracking of achievement of programmatic targets and goals. These data are also used to track the potential of a nutrition emergency in the case of drought or extreme hunger. This allows the government to efficiently utilize scarce resources for optimal outcomes.

### **OBJECTIVE 3**

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The following 15 publicly available, web-based, global nutrition databases were reviewed for scope of nutrition indicators, data quality, data sources, and functionality, with a particular focus on user-



friendliness and visualization capabilities. These databases are summarized below and categorized according to level of usability.

**High Usability:** Contain a broad scope of nutrition indicators, high data quality, valid data sources, and user-friendly web-based visualization capability.

**Low Usability:** Contain a broad scope of nutrition indicators, high data quality, and originate from valid data sources, but do not generate data visualizations through a web-based interface. These data are typically downloadable for the user to analyze on their own. Note that there is great variety in how frequently these are updated, and some contain data dating as far back as 2007.

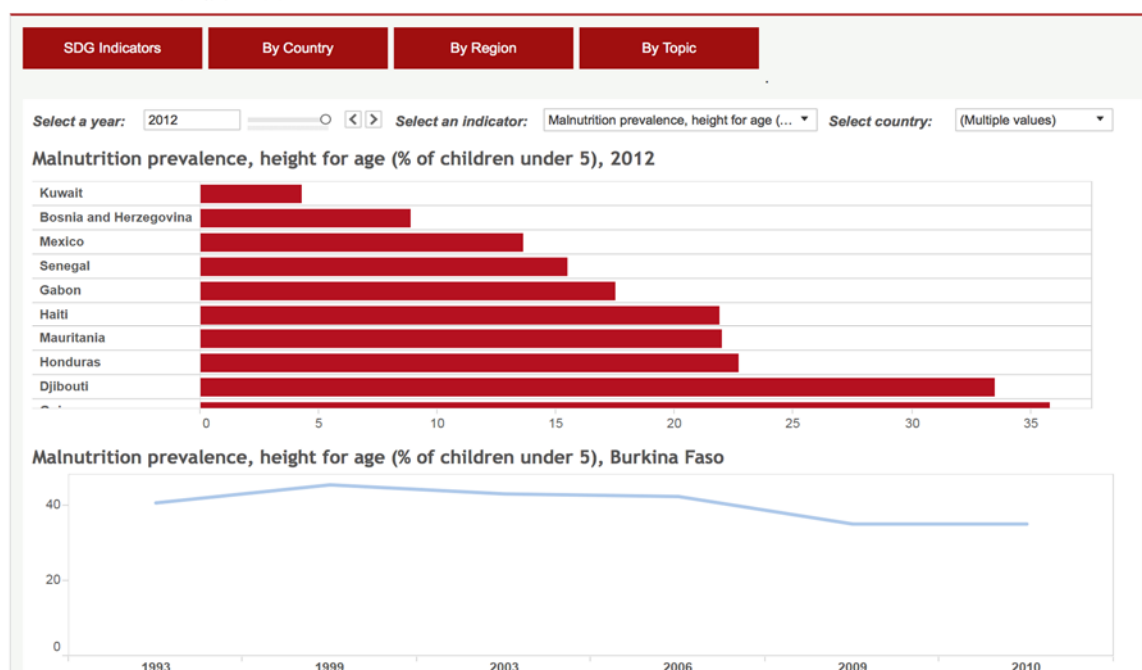
**Inoperable/Under Construction:** Databases that have features of high-usability interfaces, but which are being restructured/redeployed or are in development.

**Other Nutrition Tools, Reports, and Databases:** Other publicly available online visualizations related to nutrition, policy, and tracking global targets.

## HIGH USABILITY

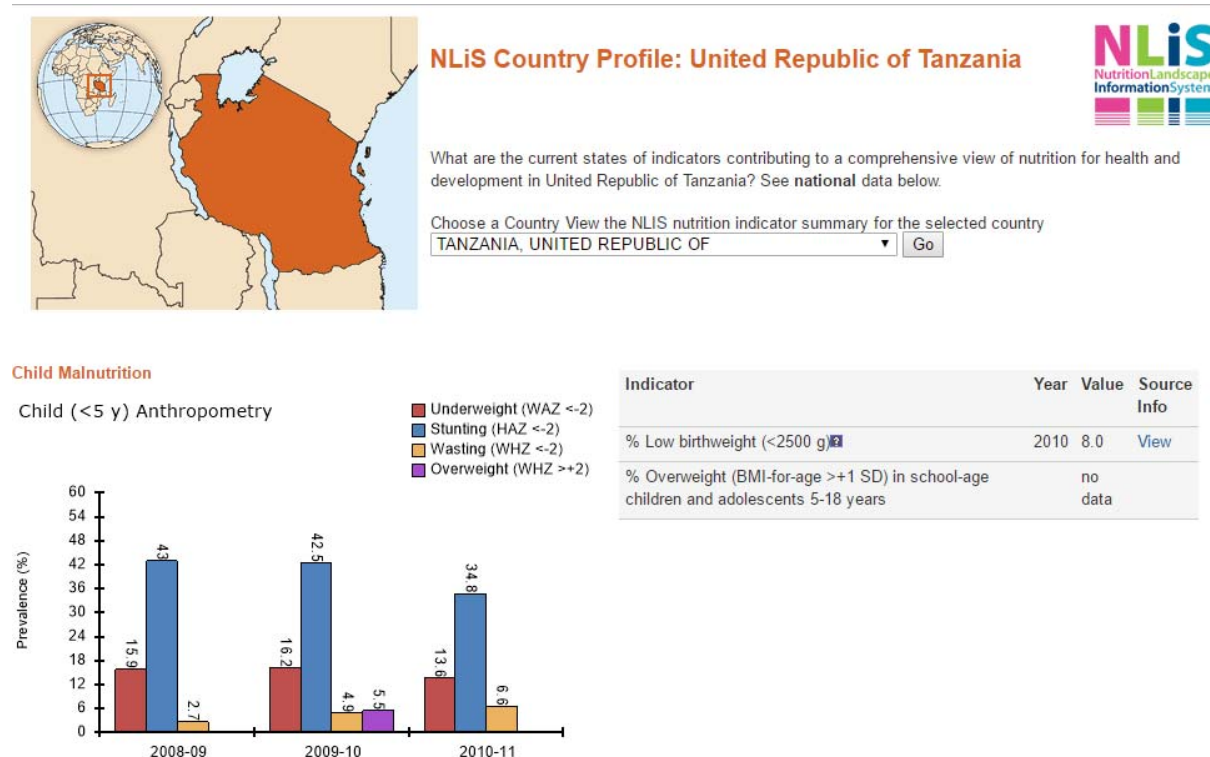
The [World Bank's Health Nutrition and Population Statistics Databank \(HNP\)](#) gathers key health, nutrition, and population statistics from a variety of international sources, including household surveys and census records. It covers a wide range of indicators in the areas of diet quality and feeding practices, anthropometry, care seeking, micronutrients, and WASH. The database has biannual updates. Users have the ability to run queries by country, indicator, and year, in addition to the ability to interact with a dashboard where they can see visualizations of certain nutrition indicators. Figure 6 shows a screenshot example of the [HNP Data Dashboard](#), showing country comparisons of malnutrition prevalence in 2012, in addition to a timeline of Burkina Faso's malnutrition prevalence from 1993 to 2010 (21,22).

**Figure 6.** Screenshot of HNP User Interface  
HNP Data Dashboards



The [Nutrition Landscape Information System \(NLIS\)](#) is intended to give country-specific overview snapshots of young children and women's nutrition, health and development, sourcing data from a variety of other nutrition databases such as the GINA and WHO Global Database on Child Growth and Malnutrition. This database is in use and the upkeep varies by country. Types of indicators used include anthropometry, WASH, diet quality and feeding practices, micronutrients, and care-seeking. Many of these data points are displayed over time. While there is limited customizability, the database pulls together many of the relevant nutrition databases into one easy view. An example of NLIS capability can be seen in Figure 7 (23).

**Figure 7.** Screenshot of NLIS User Interface



## LOW USABILITY

The [WHO Database on Child Growth and Malnutrition](#) compiles under-5 growth and malnutrition data from population-based nutritional surveys collected around the world since 1960. Indicators include stunting, underweight, wasting, and overweight. Data are compiled into web-based tables and are downloadable into multiple formats (24).

The [WHO Global Data Bank on Infant and Young Child Feeding](#) pools breastfeeding and complementary feeding information from national and regional surveys, in addition to breastfeeding studies, to offer comparisons between countries, assessments of trends, and evaluation of programs to users. Focusing on children under five and women, the database covers diet quality and feeding practices indicators. The database can produce PDF exports and appears to be last updated in 2007 (25).

The [Joint Malnutrition Dataset from the WHO, UNICEF, and World Bank](#) contains the most recent malnutrition data on stunting, overweight, wasting, and severe wasting of children, providing both global and regional figures and allowing users to explore data from 1990-2015. Data are sourced mainly



from large nationally representative household surveys and are available in a downloadable Excel document (26).

The [UNICEF Infant and Young Child Feeding Database](#) aims to allow evaluation of infant and young child feeding practices within and across countries through the collection of data mainly from large household surveys, in addition to smaller national nutrition surveys. Data on breastfeeding and diet quality are available to users in a downloadable Excel format and were last updated in October 2016 (27).

The [UNICEF Iodine Deficiency Database](#) monitors the elimination of iodine deficiency disorders through one indicator: the proportion of households consuming adequately iodized salt. Data is collected mainly from nationally representative household surveys but also partly from national estimates that come from school-based surveys or surveillance systems. The database was last updated in October 2014 and data are available in a downloadable Excel format (28).

The [UNICEF Low Birthweight Database](#) makes data available to the public on the incidence of low birthweight and the proportion of children not weighted at birth. Data come mainly from birth registries and service-based data in high-income countries, and mainly from household surveys for low- and middle-income countries. Data quality is ensured by adjusting to account for under-reporting and misreporting prior to acceptance into database. Database was last updated in October 2015 (29).

The [UNICEF Vitamin A Deficiency Database](#) presents data on the coverage of high-dose vitamin A supplementation by measuring the proportion of 6- to 59-month-olds receiving two high-dose vitamin A supplements in a given year. Data is sourced from administrative reports of national governments and UNICEF country office staff. Data quality measures are taken to prevent double counting of distributions from both campaigns and health management information systems. The database was last updated in November 2015 (30).

The [USAID Dollars to Results Database](#) provides information on USAID global impact by linking annual spending to outputs. Data are sourced from U.S. Government data-systems Phoenix and FACTS Info. A variety of indicators are covered, such as the number of children receiving vitamin A supplements and number of people trained, but nutrition data is only available for select countries. The database mostly consists of interactive visualizations of spending and results and there is little standardization between countries. There are annual updates and the database is still in use. However, data is sparse by country and year (31).

## INOPERABLE / UNDER CONSTRUCTION

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The [WHO Global Database on Body Mass Index](#) monitors nutritional status of the adult population worldwide, providing periodical updates on underweight, overweight, obesity trends and prevalence rates. The database collates already available national data, incorporating Food and Agriculture Organization data and Dietary Food Supply data to be displayed alongside BMI data on the maps and charts. However, the database is not operable currently and efforts are underway to release an information system with web-based mapping of expanded anthropometry data (32).

The [Vitamin and Mineral Nutrition Information System \(VMNIS\)](#) allows users to systematically retrieve and summarize data on vitamin and mineral status of populations, with the goal of eliminating major vitamin and mineral deficiencies. It relies on institutions, governments, non-governmental and international organizations to maintain up to date information on adults and children under five. All



indicators are micronutrient-related, including urinary iodine and night blindness. It is currently under reconstruction- the upgraded database was planned to be completely populated by the end of 2016 and a redesign of the website is currently underway, which will allow users to query information by selected variable and make graphs and tables (33).

## OTHER NUTRITION TOOLS, REPORTS, AND DATABASES

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The [Global Targets Tracking Tool](#) is designed to aid countries in setting national targets and monitoring progress through allowing users to explore various scenarios and assess necessary progress to be made. Data sources vary by country, but include DHS surveys, nutritional surveillance projects, and other national surveys. The database is in use and indicators include breastfeeding and anthropometry measures (34).

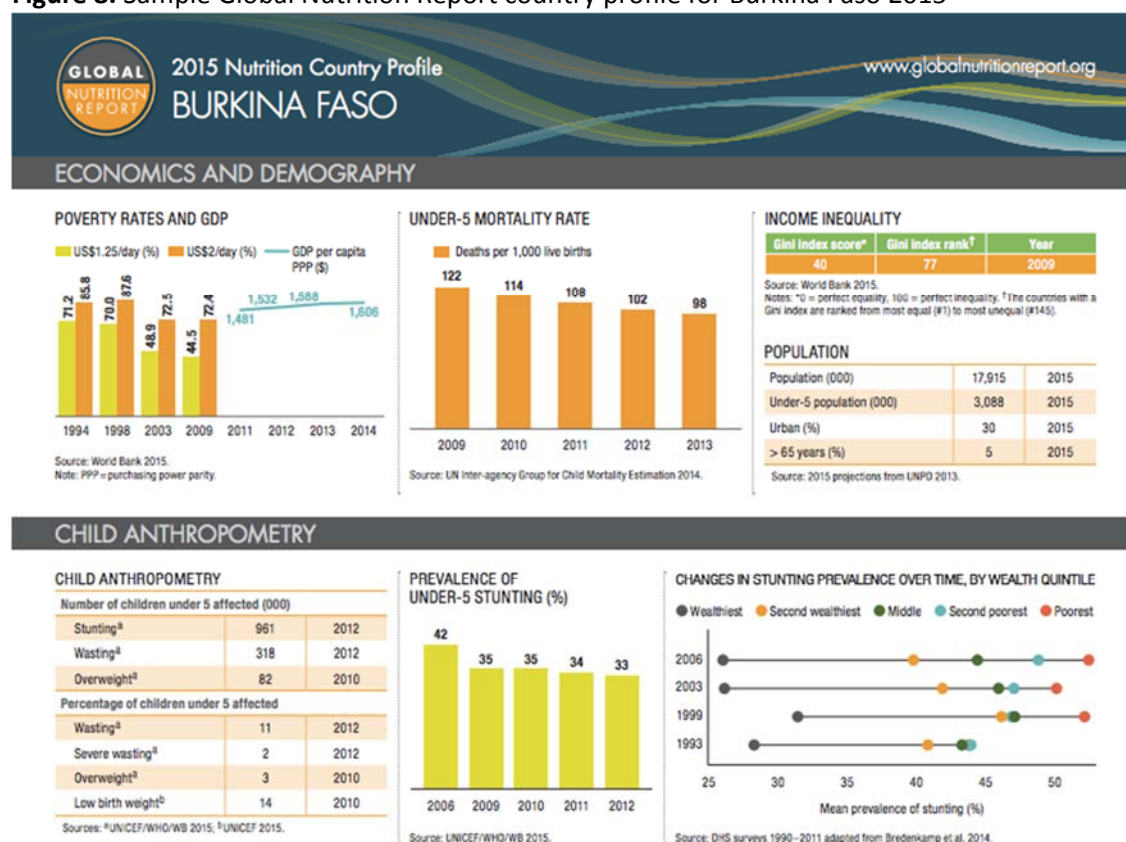
[Global Database on the Implementation of Nutrition Action \(GINA\)](#) is an interactive platform (map) for sharing standardized information on nutrition policies and action, with a range of policy indicators, such as Policy Strategies and Policy Country. Data sources include NGO and government documents and the database is linked with WHO's Nutrition Landscape Information System. While the database is in use and has an automatic verification process, the data do not lend themselves well to visualization and the exports of machine readable text are largely text and difficult to sift through (35).

The [Institute for Health Metrics and Evaluation Data Exchange](#) is a web-based interactive database that contains information on the global burden of disease. The system presents attribution of deaths and disability-adjusted life years (DALYs) to injury, infectious diseases, and chronic conditions. Due to the multifactorial mechanisms by which nutrition can cause morbidity and mortality, the system does not easily summarize the global nutrition burden (36).

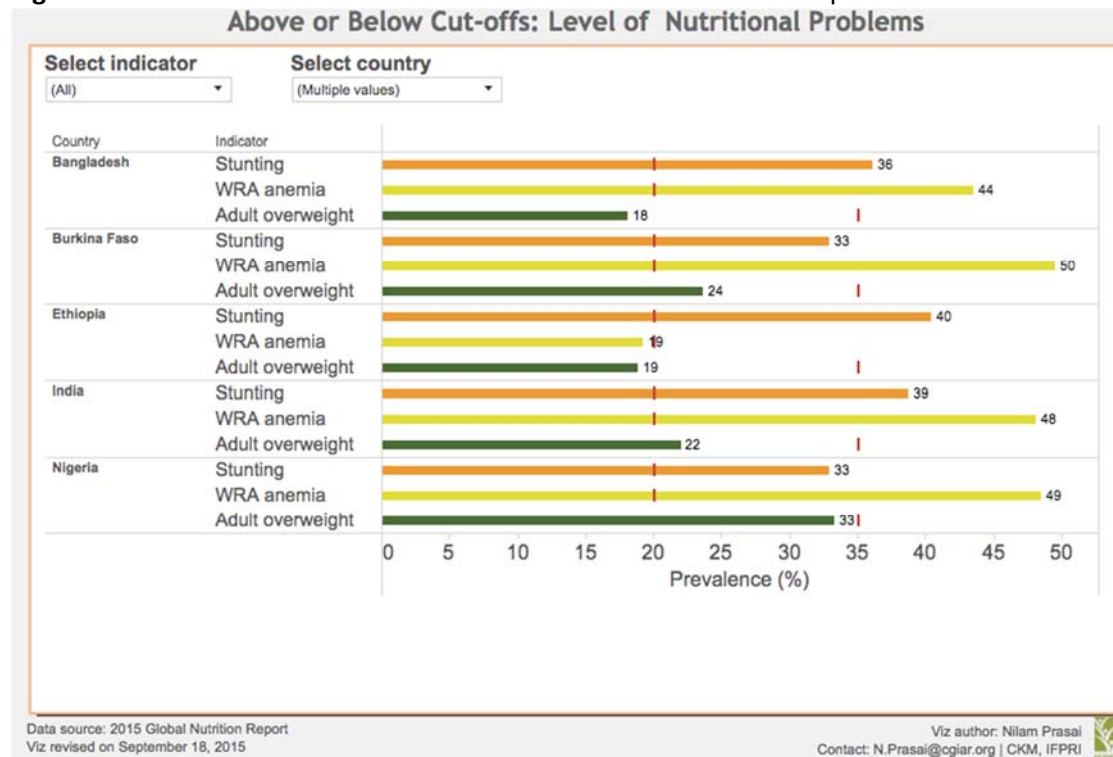
The [Global Nutrition Report](#) is an annual report detailing the status of global nutrition since 2014. Using multiple data sources, including DHS and MICS, several nutrition indicators are compiled to produce country profiles. Country profiles, including several years of data and ample citations, provide a snapshot of a country's nutrition status over time (Figure 8). The most recent country profile was released in 2015. The next release will be in 2017. A data visualization platform is also available to produce graphs (Figure 9) and a map for three indicators (stunting, anemia among women of reproductive age, and adult overweight) by country (37).



**Figure 8.** Sample Global Nutrition Report country profile for Burkina Faso 2015



**Figure 9.** Screenshot of the Global Nutrition Report data visualization tool



## DISCUSSION

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The global nutrition field has made substantial progress in collecting and disseminating strategic information to inform policies and programs. The DHS and MICS surveys each feature a wide array of nutrition-sensitive and nutrition-specific information and are considerably harmonized. However, there are nuanced differences in DHS and MICS that are reflected in the actual results presented from Nigeria. There are several reasons beyond survey question and design similarities that could lead to these differences. It is important to understand these discrepancies as this information may help inform program planning and policy. Further, while each survey contains many of the core indicators which comprise targets in global efforts such as the Sustainable Development Goals, there is still scope for expansion; namely in nutrition program and intervention coverage. We provide a list of nutrition-specific and -sensitive indicators currently not included in these surveys, which could be useful in assessing the state of a nation's nutrition.

There have been many advancements over the past decade in data science, information systems, and technology which have resulted in improvements in strategic information quantity and quality globally. However, these technological improvements alone are not sufficient to obtain optimal information systems. Collaboration between implementing parties and political will to prioritize the need to create an information system that is easy-to-use and provides value. While efforts to streamline data have been made, there is still a great need to continue those efforts, invest in data quality control, and make data accessible for planning and decision-making. DHIS2 is a flexible, readily available platform for the storage and management of routine aggregated nutrition surveillance data.

National-level nutrition data are widely available via databases managed by global health stakeholders such as the WHO and UNICEF. These databases, while well maintained, could benefit from improvements in their user interfaces. Generally, the databases lack interactive features, maps, and other tools that allow users to easily sort and filter data. The most user-friendly options, World Bank's HNP Dashboards and UNICEF's NLiS, pool together data from several other systems.

With at least 16 databases that house nutrition data, such as DHS and MICS, a plethora of nutrition data have been made available through continued national surveys. However, their usability and breadth of these databases is highly variable, and the coordination of nutritional data collection efforts could be improved. Some databases focus on a single indicator (e.g., vitamin A supplementation), while others focus on a domain of nutrition (e.g., infant and young child feeding). Two databases, the World Bank Health Nutrition and Population Statistics Databank and the Nutritional Landscape Information System, nicely pulled together a number of these databases into an easy to use, "one stop shop". These databases could still benefit from improvements in usability such as customizable maps or cross-year and cross-country comparisons. With a global effort to improve nutrition in low- and middle-income countries throughout the world, the need for harmonized, accurate, and systematically collected data is now more important than ever. Future efforts to develop prevention and treatment programs and to set policies that can further help reduce undernutrition and improve health outcomes will be aided through continued improvements in nutrition databases and data collection efforts.



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