DISTRICT ASSESSMENT TOOL FOR ANEMIA

USER'S GUIDE

NUTRITION

DISEASE CONTROL

WASH

REPRODUCTIVE HEALTH

AGRICULTURE

EDUCATION

USAID
FROM THE AMERICAN PEOPLE

SPRING
Strengthening Partnerships, Results, and Innovations in Nutrition Globally

ABOUT SPRING

The Strengthening Partnerships, Results, and Innovations in Nutrition Globally (SPRING) project is a five-year USAID-funded cooperative agreement to strengthen global and country efforts to scale up high-impact nutrition practices and policies and improve maternal and child nutrition outcomes. The project is managed by JSI Research & Training Institute, Inc., with partners Helen Keller International, The Manoff Group, Save the Children, and the International Food Policy Research Institute.

ACKNOWLEDGMENTS

The authors—Denish Moorthy, Teemar Fisseha, Barbara Knittel, Emma Stewart, Sorrel Namaste, Danya Sarkar, and Phil Harvey—would like to thank the individuals who were involved with the DATA project. The accompanying excel-based tool was developed by SPRING, in partnership with Barbara Knittel and Emma Stewart, SPRING consultants through the JSI Center for Health Information, Monitoring, and Evaluation (CHIME). The authors would like to thank the current and past members of the DATA Advisory Group. The current members of the DATA Advisory Group include Rolf Klemm (Helen Keller International), Robin Houston (John Snow, Inc.), Omar Dary (USAID), Tariq Azim (John Snow, Inc.), and Edward Bonku (John Snow, Inc.). Toby Stillman (Save the Children) also served as an Advisory Group member. Ram Shrestha (John Snow, Inc.) provided high level guidance to the project.

RECOMMENDED CITATION

SPRING. 2016. *District Assessment Tool for Anemia: User's Guide.* Arlington, VA: Strengthening Partnerships, Results, and Innovations in Nutrition Globally (SPRING) project

Revised January 2017.

SPRING
JSI Research & Training Institute, Inc.
1616 Fort Myer Drive, 16th Floor
Arlington, VA 22209 USA

Tel: 703-528-7474
Fax: 703-528-7480

Email: info@spring-nutrition.org
Web: www.spring-nutrition.org

This report is made possible by the generous support of the American people through the United States Agency for International Development (USAID) under the terms of the Cooperative Agreement No. AID-OAA-A-11-00031 (SPRING), managed by JSI Research & Training Institute, Inc. (JSI). The contents are the responsibility of JSI, and do not necessarily reflect the views of USAID or the United States Government.

DISTRICT ASSESSMENT TOOL FOR ANEMIA

USER'S GUIDE

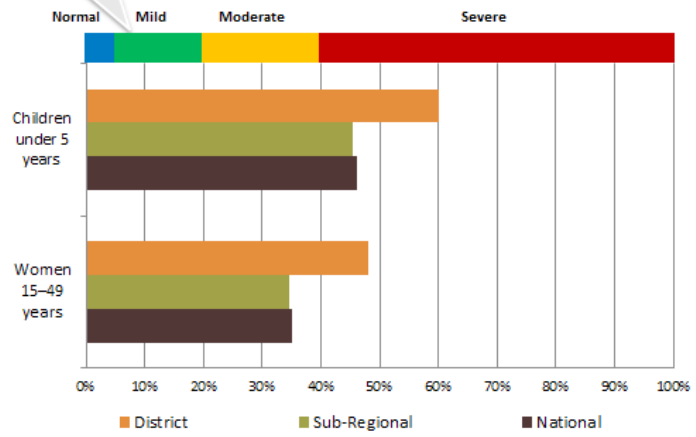
USAID FROM THE AMERICAN PEOPLE

District Assessment Tool for Anemia

SPRING Strengthening Partnerships, Results, and Innovations in Nutrition Globally

Prevalence of Anemia

WHO classification of public health significance
not anemia cutoffs



Risk Factors for Anemia

Risk Factor	Prevalence	Target Group
Malaria	**30%**	Children 6–59 months
	35%	Pregnant women
Helminth	**High**	Children 6-59 months
	Medium	Pregnant women
Vitamin A deficiency	**15%**	Children 6–59 months
Iron deficiency	**Medium**	Children 6–59 months
	Medium	Women 15-49 years

Vitamin A and Iron represent national level indicators

Multiple sectors play a role in anemia prevention and treatment.

Nutrition

Vitamin and mineral deficiencies cause anemia through inadequate production of red blood cells.

Disease Control

Malaria and **Helminth infections** result in anemia due to increased destruction of red blood cells and intestinal blood loss, respectively.

Reproductive Health

Early childbearing and **inadequate birth spacing** can cause anemia due to insufficient time to replenish iron stores.

Water & Sanitation

Unsafe drinking water, poor sanitation, and **inadequate hygiene practices** increase the risk of infection and can cause anemia.

Agriculture

Agriculture interventions improve income and dietary diversity for families, leading to improved anemia status.

Education

Deworming and **hygiene education** lead to less infections and improved anemia status.

Table of Contents

Acronyms and Abbreviations

ANC	antenatal care
CDC	U.S. Centers for Disease Control and Prevention
DATA	District Assessment Tool for Anemia
DHS	Demographic and Health Surveys
FP	family planning
GDP	gross domestic product
HF-TAG	Home Fortification Technical Advisory Group
HIV/AIDS	human immunodeficiency virus/acquired immune deficiency syndrome
HMIS	Health Management Information System
IFA	iron–folic acid
IPTp	intermittent preventive therapy in pregnancy
IRS	indoor residual spraying
ITN	insecticide-treated net
LLIN	long lasting insecticide-treated net
MIYCN	maternal, infant, and young child nutrition
MNP	micronutrient powder
SPRING	Strengthening Partnerships, Results, and Innovations in Nutrition Globally project
UNICEF	United Nations Children's Fund
USAID	U.S. Agency for International Development
WASH	water supply, sanitation, and hygiene
WHO	World Health Organization

Introduction to DATA

The District Assessment Tool for Anemia (DATA) is a generic toolkit that helps districts assess their current anemia situation. The U.S. Agency for International Development (USAID)-funded Strengthening Partnerships, Results, and Innovations in Nutrition Globally (SPRING) project has developed the toolkit to assist countries in strengthening anemia programming at the district level.

Anemia is an urgent public health problem that affects children and women throughout the life-course and results in a high burden of morbidity and mortality. Anemia is caused by multiple factors, most notably, iron and other nutrient deficiencies, malaria, helminthes, non-specific inflammation, and genetic blood disorders. Preventing and controlling anemia require an understanding of the leading causes of anemia in a given setting and developing integrated programs to address these underlying causes. As governments decentralize, it becomes even more important to work at the district level to promote integrated programs that address the leading causes of anemia.

The DATA tool is created in Microsoft Excel, and builds upon the software's multi-page functionality. The data entered into the tool is transformed into easy to read dashboards. All of the Excel pages are designed to be printable sheets so that the user can also print them out for use in low-resource settings. The DATA is meant to be used at the district level in the context of a facilitated district workshop or meeting. This User Guide describes the rationale, the structure and use of the tool. The guide is divided into 4 parts. Part 1 describes the need for reducing anemia and the role of the DATA tool within those efforts. Part II provides an overview of the structure of the tool. Part III briefly highlights the use of the tool within a facilitated district workshop/meeting. Part IV provides key evidence for the interventions for reduction of anemia that have been suggested within the tool.

Specifically, the DATA will help district managers—

- determine the main factors that cause anemia in their setting
- identify enablers and barriers to addressing anemia
- prioritize interventions and identify actions to strengthen anemia-related programming.

The toolkit is intended to be used by district program managers and technical assistance providers to stimulate discussions, facilitate an analytic process, and develop a prioritized district anemia plan.

Part I: Background

WHY WORRY ABOUT ANEMIA?

Anemia occurs when there are too few red cells or too little hemoglobin in the cells to allow the body to function properly. Anemia is a major public health problem that increases mortality and morbidity. It also substantially reduces economic and education opportunities for individuals, communities, and nations.

The relationship between maternal anemia and mortality is critically important. Globally, iron-deficient anemia alone contributes to 115,000 maternal deaths and 591,000 perinatal deaths each year. Most of these maternal deaths result from women with mild and moderate anemia, even though the risk to individual women with severe anemia is much higher. For women with hemoglobin levels between 50 and 120 g/L (5–12 g/dL), increasing hemoglobin to 10 g/L (1 g/dL) will decrease the risk of maternal death by 20 percent (Stoltzfus et al. 2004).

The effects of maternal anemia on the newborn include higher rates of infant mortality, pre-term delivery, and low birthweight while increasing the risk of reduced cognitive development in the child. Anemic adults have less energy than non-anemic adults, so they work less productively. Economists estimate that anemia reduces national production by $3.64 per capita or 0.81 percent of gross domestic product (GDP) (Horton 2007).

Anemia is one of the most common health disorders. Globally, in 2011, anemia affected 43 percent of children under five years old, 29 percent of non-pregnant women, and 38 percent of pregnant women. The problem of anemia is most widespread in Central Africa and West Africa, where 71 percent of children under five years old, 48 percent of non-pregnant women, and 56 percent of pregnant women are affected (Stevens et al. 2013).

CAUSES OF ANEMIA

Anemia is a complex condition with many causes. For this reason, it is common for program managers to focus only on the most obvious interventions without full consideration of some of the other critical contributors to anemia. The toolkit is designed to help district managers understand the multiple causes of anemia. It is also designed to help them analyze the interventions that can reduce anemia among women and children.

Iron Intake, Stores, and Losses

One of the biggest contributors of anemia is low intake of absorbable dietary iron to meet the needs of the body, particularly during adolescence and pregnancy and during periods of rapid growth in infants and during childhood. Other nutrients, such as vitamin A, folic acid, and vitamin B12, are needed for red cell production and for iron to be transported to and from stores. A diverse diet rich in vitamins and minerals, particularly animal source foods, adequately addresses this need, except in pregnancy when iron supplementation is always required.

Addressing food and nutrition insecurity is an important long-term intervention. However, in many

countries diets are more limited, and some form of iron supplementation is needed to increase iron intake. Iron and folic acid (IFA) supplementation for pregnant women and adolescent girls—and micronutrient powders (MNP) and high-dose vitamin A for young children —are important interventions. Fortification of staple foods with iron, and other vitamins and minerals can also increase iron intake and reduce anemia in the whole population. Newer biofortification techniques are also used to increase the iron content of staple crops by use of plant breeding or genetic modification techniques.

Iron stores are reduced in women during menses and childbirth. Starting with menarche, girls need more iron than boys. Blood loss during childbirth and inadequate spacing between births contribute to loss of iron stores. Family planning interventions to increase the birth interval can allow women to maintain adequate stores. Agricultural interventions such as home gardens, agricultural extension training, farmer field schools, and animal husbandry projects are designed to increase access to, and availability of, micronutrient-rich and biofortified crops for household consumption, thus improving diet and nutrition status through increased food security.

Infections and Inflammation

Where malaria is common, it is a major direct cause of anemia, particularly in infants, young children, and pregnant women. Malaria causes anemia both directly by destroying red blood cells and indirectly by decreasing production of new red blood cells. Malaria interventions, such as use of bed nets, intermittent preventive treatment during pregnancy (IPTp), and overall management of clinical cases, are critical for reducing anemia. Among the general population iron is directly lost from a variety of parasitic infections that cause bleeding (such hookworm or schistosomiasis). Interventions to reduce the frequency and intensity of other infections, such as deworming for intestinal parasites, are also important.

Anemia is also caused by the inflammation that accompanies infections, including subclinical infections. Inflammation, through the action of the hormone hepcidin, decreases red blood cell production and restricts iron absorption, indirectly causing anemia. Interventions to reduce this background level of infection are therefore very important in reducing anemia. Breastfeeding helps reduce the risk of infection in newborns. Appropriate prevention and treatment of diarrhea in infants and children can reduce the adverse impact of infections on anemia. Water, sanitation, and hygiene (WASH) interventions, including latrine use and handwashing, may be critical to reduce the background infection that can limit the ability to absorb and metabolize iron.

Genetic Factors

Genetic traits such as sickle cell and thalassemias can contribute to anemia, but their contribution to the burden of disease has not been quantified. There is a high degree of variability in the clinical presentation of the diseases caused by these traits, but it is difficult to predict the expression of given genetic traits. The treatment of these traits is done through clinical facilities with programs of newborn screening and treatment. There is increasing concern that a) with the epidemiological transition of reduced child mortality, a greater number of children with these genetic diseases will survive and present for clinical treatment; and b) countries may not have the capacity to cope with the great increase in the

number of clinical cases (Weatherall 2008). As yet, this is not a concern for the public health program manager.

RELATIVE CONTRIBUTION OF THE CAUSES OF ANEMIA

Researchers have great difficulty determining the relative contribution of each of the causes described above within populations or individuals. However, globally about 50 percent of anemia is due to iron deficiency; reliable estimates have not been made for the different regions of the world. Where malaria is prevalent, the contribution from iron deficiency alone is likely to be less than in areas without malaria. The contribution from general inflammation is not known, though it may be much more than has been previously considered. The contribution from the variety of genetic causes is not well understood in part because of the variable expression in a population.

INTERVENTIONS FOR REDUCTION OF ANEMIA

Anemia prevention needs synergy between nutrition-specific and nutrition-sensitive interventions. Nutrition-specific interventions related to anemia like dietary interventions, infant and young child feeding, supplementation and fortification lie within the realm of the health sector while nutrition-sensitive interventions are housed under agriculture, education, social welfare, and public health. DATA includes a mix of interventions covering multiple sectors, all of which can have an impact on anemia.

Part IV provides a list of key references for the key anemia interventions along with comments. For most of these interventions, there are studies that link effective implementation directly to reduced anemia. For some, the relationship is implied. For example, breastfeeding is known to reduce risk of infection, which is known to contribute to anemia. Some recent studies have suggested that earlier associations may not be as reliable as previously thought. For example, a recent Cochrane review questions whether universal deworming has improved anemia. This reference list should be useful in understanding the scientific basis for the interventions covered in the toolkit.

ROLE OF DATA IN ANEMIA PROGRAMS

The comprehensive nature of the DATA allows users to see facets of anemia prevention and control that they might have not previously considered, leading to further awareness on anemia. The tool is not an end in itself – it will help districts coordinate efforts across sectors and reach a consensus on anemia activities that need to be prioritized. Its use will supplement other district level efforts by every sector to improve nutrition and anemia status.

Part II describes the general structure of DATA and how to navigate through its design elements.

Part II: DATA Structure

GENERAL ORIENTATION

DATA is a Microsoft Excel workbook that consists of the following worksheets (tabs):

Worksheet Name	Description
Tool Overview	Information on tool and use - Provides the key informant/ respondent(s) an overview of the audience, intended respondent, purpose, and approach, along with instructions on completing the toolkit.
National Questionnaire	The national level key informant/respondent(s) is/are asked to fill out a questionnaire to capture information on the status of national policies related to the prevention and control of anemia, as well as information on the national anemia prevalence and, if available, the national prevalence of iron and vitamin A deficiency. If available, Demographic and Health Survey (DHS) data on the national and regional prevalence of anemia can help inform this questionnaire.
District Questionnaire	Workshop participants are asked to fill out a questionnaire to capture information on the prevalence of anemia and its risk factors and the current status of interventions at the district level. When prevalence or program coverage data is not available, workshop participants are asked to qualitatively rate the prevalence and coverage data. The questions are divided by the following topics: nutrition, infection/ inflammation, water and sanitation, reproductive health, agriculture, and education.
Overview Dashboard	The Overview Dashboard provides a "snapshot" of the situation of anemia and risk factors for anemia at the district level as compared to national and sub-national levels. The information is populated from the national and district level questionnaire. The Dashboard also highlights the various sectors that have to be involved in integrated control of anemia.
Findings Dashboard	The Findings Dashboard is populated once data entry is complete. The dashboard includes a summary of interventions to address anemia. The anemia situation is summarized by topic area - nutrition, infection and inflammation, reproductive health, water and sanitation, agriculture, and education. Information on policies, existence of programs, and their coverage is presented.

Worksheet Name	Description
Indicators	If/when questions around indicator definitions arise while filing out the District Questionnaire, the facilitator and workshop participants can refer to the Indicators tab. The indicators listed define anemia in various population groups, its risk factors, and corresponding program coverage. Their numerator and denominator columns define how the indicator is calculated. If the participants change the indicator during the workshop, they should document the changes in the 'changed indicator' column for future reference
Notes	Throughout the workshop, the designated note-taker should be recording key discussion points, especially noting critical barriers to address and ideas for activities/interventions during the prioritization process on the second day. All notes should initially be captured in Microsoft Word, and then incorporated into DATA's Notes tab before the end of the workshop. Detailed instructions for integrating the notes from Word into Excel can be found in the Notes tab.

NAVIGATING DATA

Users can navigate from one tab to another as you would in any other Excel workbook by selecting a tab at the bottom of the workbook, and also by utilizing the directional buttons on the screen (see examples in Figures 1 and 2).

Figure 1. Examples of Advance Buttons

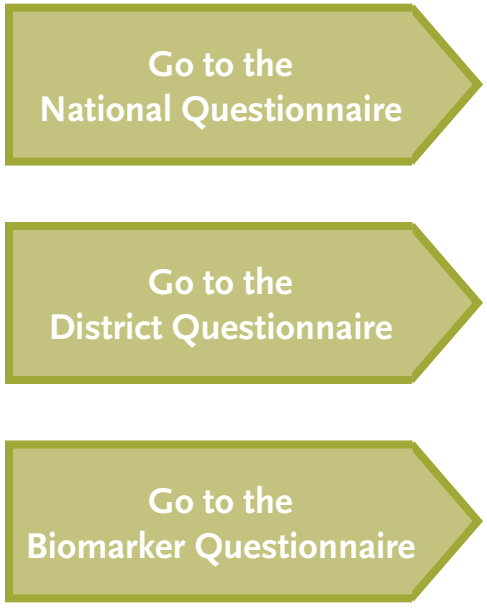


Figure 1. Example of a Return Button

It is recommended that you advance through the worksheets in the order they appear in the workbook. The National Questionnaire should be filled in advance of your use of the tool at the workshop.

INPUTS

National Questionnaire

The National Questionnaire shown below will be filled up prior to the district workshop.

National Anemia Questionnaire		
1	National prevalence of anemia among women of reproductive age (15-49 years).	23%
2	National prevalence of anemia among children 6-59 months.	49%
3	Sub-regional prevalence of anemia among women of reproductive age (15-49 years).	30%
4	Sub-regional prevalence of anemia among children 6-59 months.	68%

District Questionnaire

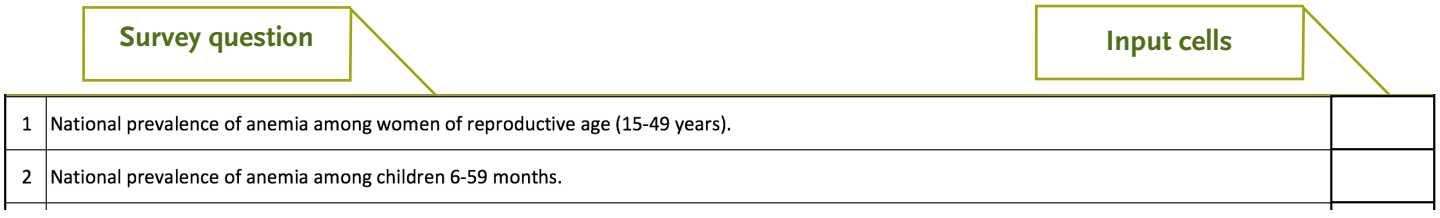
The District Questionnaire shown below provides the data inputs to the Dashboard.

District Anemia Questionnaire		
Section 1. General Anemia Questions		
1	Percentage of women 15-49 years with anemia (hemoglobin < 12 g/dL) in your district.	
1a	How would you describe the prevalence of anemia among women of reproductive age (15-49 years) in your district?	High
2	Percentage of children 6-59 months with anemia (hemoglobin < 11 g/dL) in your district.	84%
2a	How would you describe the prevalence of anemia among children 6-59 months in your district?	

DATA ENTRY

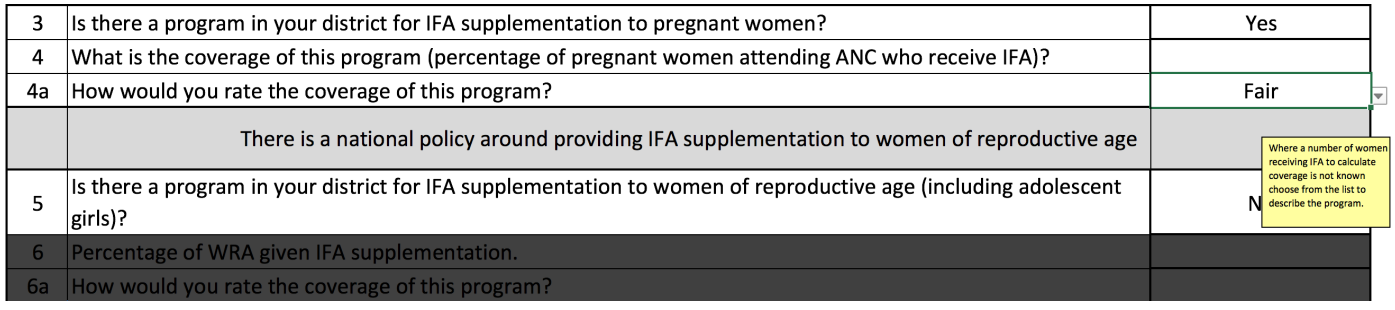
Entering Information in DATA

For ease of use, cells in the workbook have been locked, with the exception of input cells. These are outlined in black.



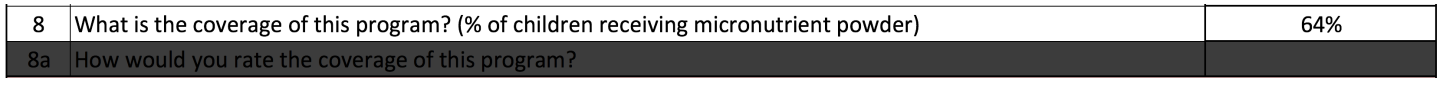
Additional Guidance within Cells

Some cells contain additional guidance upon selecting the cell. This will appear in a yellow box once you have selected a cell (see example).



Skip Patterns

DATA allows for the collection of both quantitative data as well as qualitative assessments where data is not available. Only one type of response needs to be completed. If quantitative data is entered, the qualitative question will automatically be greyed out (see example). The dashboards are able to display either type of data.



The same is true of questions that need not be answered based on a previous response. For example, if there is no program for IFA supplementation to pregnant women, the subsequent questions about that program will be greyed out (see example).

5	Is there a program in your district for IFA supplementation to women of reproductive age (including adolescent girls)?	No
6	Percentage of WRA given IFA supplementation.	
6a	How would you rate the coverage of this program?	

OUTPUTS

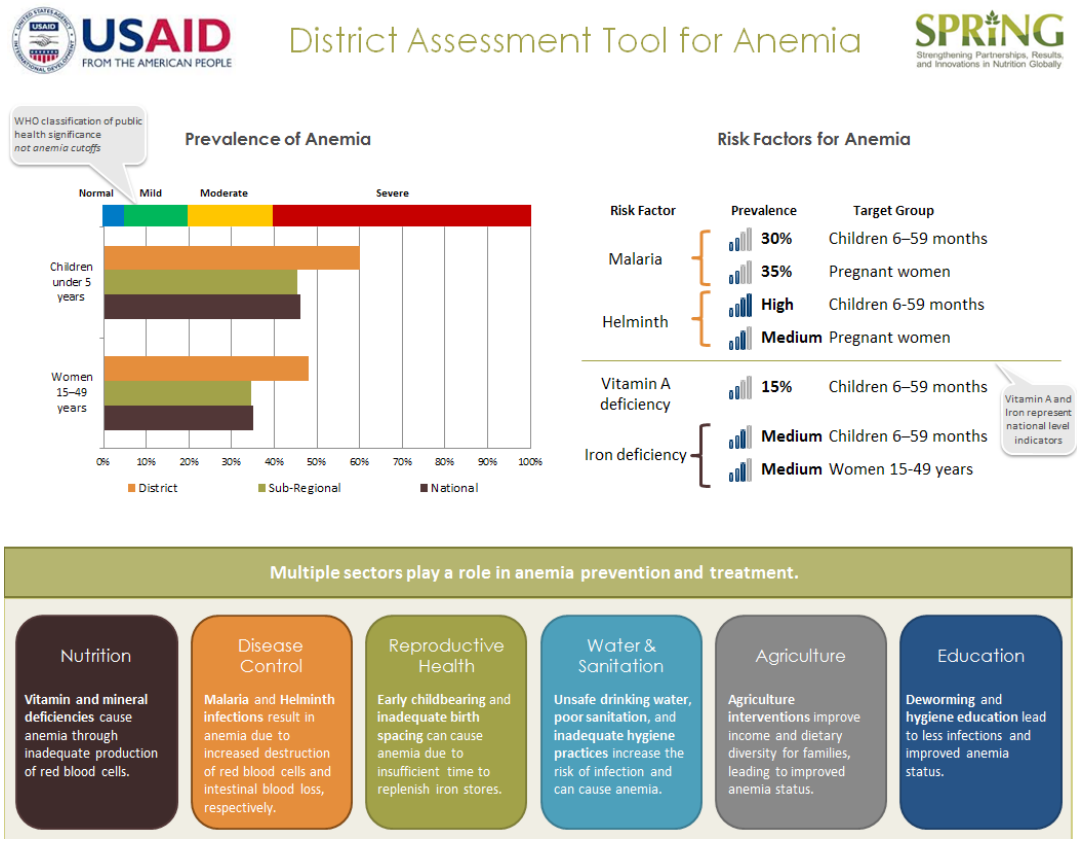
Dashboards

DATA is intended to convert data into digestible information that can be used to inform program planning. This is done through the use of dashboards. When information is entered on the questionnaire screens, it is presented on Overview or Findings Dashboards. These dashboards can be used to assess the anemia-related information for a particular sector and are designed so they can be easily printed and shared. **Data on the dashboards draw from various questionnaires, as such the dashboards are best viewed only after all data has been entered.**

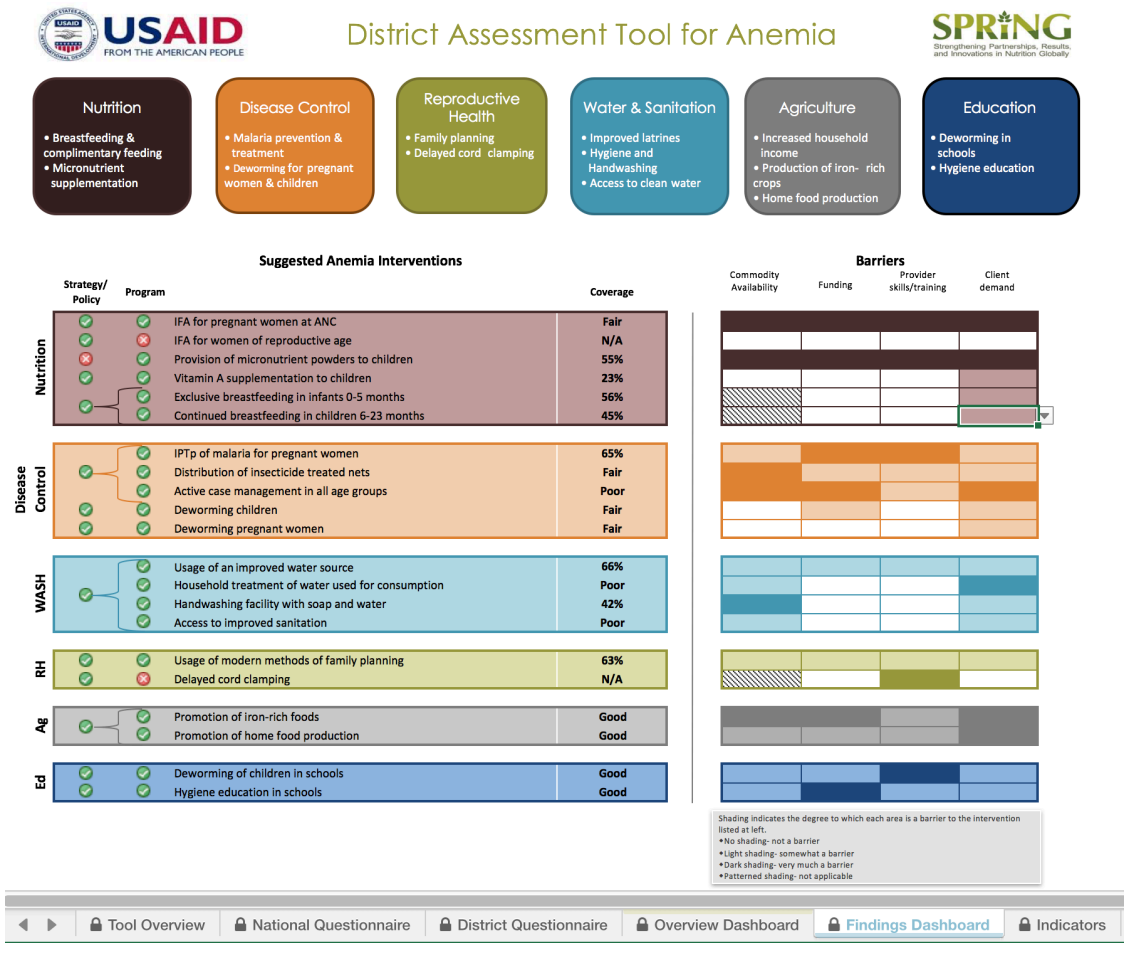
Navigating the Dashboards

Once you have completed the data entry in DATA questionnaire tabs, you will be able to view your information, along with guidance on anemia interventions in two dashboards.

As shown below, the Overview Dashboard tab displays high-level data, including: anemia prevalence for children under 5 years and women 15–49 years at the national, sub-national, and district levels; prevalence of anemia risk factors; and an overview of the sectors involved in anemia reduction. Click on the titles to advance to that sector's section in the findings dashboard.



The Findings Dashboard includes: a list of interventions that are available for anemia reduction, and policy and program coverage information for these suggested programs in your district, based on the answers you provided in the National and District Questionnaires. The dashboard also includes a section on barriers to each of the suggested programs, which participants will complete as one large group. Depending on the data that is entered in the questionnaires, the information shown may be quantitative or qualitative.

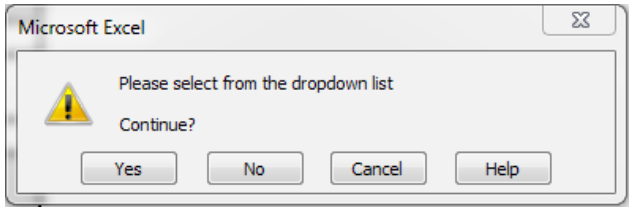

USAID
FROM THE AMERICAN PEOPLE
District Assessment Tool for Anemia
SPRING
Strengthening Partnerships, Results, and Innovations in Nutrition Globally
Nutrition
• Breastfeeding & complimentary feeding
• Micronutrient supplementation
Disease Control
• Malaria prevention & treatment
• Deworming for pregnant women & children
Reproductive Health
• Family planning
• Delayed cord clamping
Water & Sanitation
• Improved latrines
• Hygiene and Handwashing
• Access to clean water
Agriculture
• Increased household income
• Production of iron- rich crops
• Home food production
Education
• Deworming in schools
• Hygiene education
Suggested Anemia Interventions
Strategy/ Policy
Program
Coverage
Barriers
Commodity Availability
Funding
Provider skills/training
Client demand
Nutrition
IFA for pregnant women at ANC — Fair
IFA for women of reproductive age — N/A
Provision of micronutrient powders to children — 55%
Vitamin A supplementation to children — 23%
Exclusive breastfeeding in infants 0-5 months — 56%
Continued breastfeeding in children 6-23 months — 45%
Disease Control
IPTp of malaria for pregnant women — 65%
Distribution of insecticide treated nets — Fair
Active case management in all age groups — Poor
Deworming children — Fair
Deworming pregnant women — Fair
WASH
Usage of an improved water source — 66%
Household treatment of water used for consumption — Poor
Handwashing facility with soap and water — 42%
Access to improved sanitation — Poor
RH
Usage of modern methods of family planning — 63%
Delayed cord clamping — N/A
Ag
Promotion of iron-rich foods — Good
Promotion of home food production — Good
Ed
Deworming of children in schools — Good
Hygiene education in schools — Good
Shading indicates the degree to which each area is a barrier to the intervention listed at left.
•No shading- not a barrier
•Light shading- somewhat a barrier
•Dark shading- very much a barrier
•Patterned shading- not applicable
Tool Overview
National Questionnaire
District Questionnaire
Overview Dashboard
Findings Dashboard
Indicators

FREQUENTLY ASKED QUESTIONS

Q: Why are the dashboards empty?

A: The information on the dashboards will populate only after the questionnaires have been completed. If you are seeing blank areas on a dashboard, return to that portion of the questionnaire and ensure you have completed all of the questions.

Q: What does this error mean?



A: You have received this error because you have entered a value not listed in the dropdown menu. While you can continue with the value you have entered (select "Yes"), we recommend you select from the dropdown menu (select "No" and choose from the menu).

Q: What do I enter if I don't have data?

A: Where available, quantitative data should be used. However, in the absence of quantitative data, you may leave that question blank and provide a qualitative assessment (using dropdown menu) in the subsequent question.

Part III: Overview of District Workshop

The following section provides a systematic overview of how DATA is used to prioritize interventions for anemia reduction. The bullets under each step are the main action points.

The national questionnaire should be filled before the district questionnaire. Ideally, a national level key informant/ respondent(s) will be able to pre-populate the National Questionnaire. In addition, the National Anemia Profiles, developed by SPRING and available at www.spring-nutrition.org/national-anemia-profiles, accompany DATA and provide a "snapshot" of the anemia situation in the country. If a National Anemia Profile has been developed for the country in question, it is useful to review it prior to using DATA. The National Anemia Profile shows the current accepted approaches to address anemia. These approaches are applicable to the ones districts will use.

The National Anemia Profile also includes information on which currently accepted World Health Organization (WHO) recommendations related to anemia have been adopted as policies in a given country. Some countries will have all current WHO-accepted interventions as part of their national strategy. Others will have some that are not yet policy or some that are being considered. In addition, data on the national prevalence of anemia and a number of key indicators that describe the current situation for the country are included in the National Anemia Profile. The data used for these indicators are derived from national surveys, commonly the DHS, which are usually done every five years. These data points can be used to answer the prevalence questions in the national questionnaire. However, these surveys provide accurate data at the national and regional levels but not at the district level. In the absence of national level data, regional data can be reported. If there is no data at either the national or regional level, then the questions can go unanswered, which will highlight the gaps in the evidence.

Reviewing the National Anemia Profiles is a useful first step to follow while completing the National Questionnaire, but it is not sufficient on its own. It is very important to triangulate the information in a country's National Anemia Profile by having the appropriate, key informants at the national level review its contents, and by checking for newly released survey findings or updated policies. For some countries, National Anemia Profiles may not have been developed. In this case, the National Questionnaire can be filled using information from key informants, policy documents, and survey findings.

The national context is very important with regard to the enumeration of the leading causes of anemia. National level data drives the prioritization of strategies to reduce anemia. This may also be true for the district context, with some districts mimicking the national situation, while others are substantially different.

STEP 1: REVIEW THE ANEMIA SITUATION

- Review anemia and risk factor prevalence data at the national and district levels

The first step in the analytic process is to review broadly the situation for anemia and determine what information is available for this analytic process. Anemia is very common in both women and children, thus it is likely to be a problem in the district. However, it is possible there are no data on anemia. Anemia is usually assessed using a blood test, which is often not available outside of hospitals. Anemia can be roughly assessed looking at eyelid or palmar color, but this is not commonly done and is not very precise. In some countries, districts may have anemia assessment done at peripheral facilities. If this is the case, these data should be gathered and reviewed to understand the extent of the problem in comparison with

Strategies to Increase Iron Intake, Improve Iron Stores, and Reduce Losses

Undernutrition, including poor iron intake, may be a significant factor for over half of the anemia cases, so it is very important to address it. Improvement in iron intake and stores has been clearly shown to reduce anemia prevalence. Pregnancy increases the need for iron, which is not possible to meet solely through diet. Thus, iron supplementation during pregnancy is a nearly universal intervention throughout the world. Women who enter the child-bearing years with low iron stores are at a disadvantage, so measures to increase iron stores are important. In countries with limitations in dietary diversity and adequacy, iron supplementation for women of reproductive age, especially adolescents, can improve iron stores.

Infants are at high risk of being anemic, particularly if their mothers are anemic. Delayed cord clamping is a proven intervention to improve infant iron stores, but it is not established policy in many countries. Micronutrient powders can treat anemia in infants and young children. This intervention also can be synergistic with programs to improve the vitamin A status in children under the age of five.

Pregnancy (with the normal blood losses during delivery) increases substantially a woman's iron requirements. If these are not met, iron stores are reduced. If a woman becomes pregnant again with a short birth interval, this reduction in stores increases her risk. Hence, family planning interventions directed toward increasing the birth interval are important preventive measures to reduce anemia.

Mass fortification of staple foods with an adequate amount of fortificant can improve the overall anemia status of populations consuming these fortified staples. In countries with fortification programs, work at the district level to increase awareness and use of fortified staples may increase the impact of this population-based intervention.

Agricultural programs including home food production can increase yields of micronutrient-rich crops, increase revenue to the household, and improve a household's access to foods rich in micronutrients, thus alleviating the deficiency of intake.

the national figures. If this is not the case, it may only be possible to assume that the anemia prevalence for the district is somewhat similar to the national levels.

It is also important to try to understand the relative contribution of the various causes of anemia. Clearly, there is no good way to do this since all causes contribute in different ways; there is also little data on how to tease out the relative contribution of each. However, in broad terms, it is useful to estimate whether certain factors are significant. For example, malaria may be present, but the prevalence is low and thus not a major factor. Similarly, schistosomiasis may not be present in the district, or the district may be very food insecure, making the contributions from these factors different from the national situation.

In assessing the anemia situation at the district level, there are significant data limitations. At the national level, it is possible to use DHS data that provide information on mothers, children, and households (in a representative sample). However, DHS data are usually only available at the subnational level, not at the district level. Thus, district managers may need to try to estimate their situation by using existing Health Management Information System (HMIS) data or by using their own field experience. For example, while the national-level surveys use DHS data

Strategies to Reduce Infections and Inflammation

Interventions to reduce infections, which directly and indirectly reduce anemia risk, and the accompanying inflammation have been shown to improve overall nutrition and reduce mortality.

Breastfeeding, particularly early initiation to ensure consumption of colostrum, is important in transferring antibodies to the newborn, thus reducing infection risk. Exclusive breastfeeding also reduces infection risk by limiting the exposure to external pathogens from unclean water or food. Both types of breastfeeding also contribute to the infant's nutrition.

In countries with high levels of malaria endemicity, the disease is a major contributor to anemia. Malaria causes red blood cell destruction, loss of the iron within the cells, and overall inflammation, leading to anemia. Hookworm and schistosomiasis cause anemia by direct blood loss. Thus interventions directed at reducing the burden of these diseases are critical to improving anemia.

Infection is emerging as a critical contributor to anemia. Infection from any cause, including HIV/AIDS, diarrhea, pneumonia, and various parasitic diseases, can cause inflammation even when the clinical disease is mild or even subclinical. Inflammation increases the regulatory protein hepcidin, which has a dual role in infection and iron metabolism. Increased hepcidin reduces iron absorption and affects iron metabolism effectively increasing the risk of anemia. Thus, the context in which a population lives—including their access to clean water, use of latrines, and overall hygiene—is critical regarding the risk of infection and its contribution to anemia. Interventions to reduce this risk include the WASH interventions as well as the preventive and treatment programs for common infections.

to provide an estimate of the percentage of pregnant women who were given IFA, the district personnel will likely rely on reported figures from the antenatal clinic (ANC) visit to estimate this percentage, while recognizing that women who do not come in for an ANC visit may be the most vulnerable.

For the district questionnaire, it will be useful to pull together as much existing information as possible that can help with the analytic discussions. The district questionnaire is also a stimulus to identify the roles and responsibilities of district officials within each sectoral intervention. Data should be identified from the existing HMIS data. Data should also be identified from other sector databases and special surveys or other sources of information from partners. In addition, district staff members are familiar with the situation in their district and often have a good sense of what is working and what is not. In the absence of quantitative data, the District Anemia Assessment Tool allows district staff to enter data using a subjective scale.

STEP 2: REVIEW ANEMIA PROGRAMS

- Review the status of anemia-related interventions in the district

The national and district questionnaire have a list of questions that attempt to evaluate the contributing risk factors for anemia and the program approaches to address them. The contributing risk factors are assessed by either quantitative or qualitative rating questions about the burden of disease. The questions relevant to the programs relate to the quantitative or qualitative indicators of their coverage, barriers to implementation, and any logistical issues related to commodities supplied under the program. For analysis, it is vital that data from either the quantitative indicators or, in their absence, the qualitative rating scales are filled.

Approaches to address anemia generally aim to 1) improve iron intake, increase iron stores, and reduce iron losses; and 2) reduce infections and the accompanying inflammation. Of the modules, the Nutrition, Reproductive Heath, and Agriculture sectors reflect the former while the infections and inflammation, and Water and Sanitation, Disease Control, and Education are aimed at the latter. However, considerable overlap exists between these categories. For example, deworming directly reduces iron losses and reduces infection and the inflammation that can cause anemia. However, the classification by sector makes it easier to organize the different interventions and assess their effectiveness. The interventions in each of these categories, when implemented effectively, can make a difference in anemia prevalence. It is also important to view anemia comprehensively. Addressing only one cause—for example, by ensuring pregnant women take iron tablets—may only address a component of the problem, thus may not achieve optimal results. Infection, for example, may be more important than previously understood, and the metabolic effects of infection may limit the ability to absorb iron, making iron supplement programs less effective. Thus, in this example, programs of iron supplementation, and control and prevention of infection should be implemented together. Some of the strategies aimed at implementing the two aforementioned approached are listed subsequently.

Organization of Interventions in the DATA

The DATA separates various causes of anemia and programs directed at these causes. This allows districts to determine how to best prioritize their activities most efficiently to get the greatest return on their effort. The questions in the DATA are stratified based on the sectors that implement the program. By taking a comprehensive multisectoral approach, it should be possible to improve the effectiveness and efficiency of anemia interventions.

The sectors and interventions are divided as follows.

NUTRITION

1. IFA supplementation during pregnancy
2. IFA for women of reproductive age, including adolescent girls
3. Vitamin A supplementation for children under five
4. MNP for 6–23 months old children
5. Exclusive breastfeeding through six months
6. Continued breastfeeding for children 6–23 months

DISEASE CONTROL

1. Malaria prevention with bed nets (insecticide-treated nets)
2. Intermittent preventive treatment of malaria in pregnancy
3. Malaria case management
4. Deworming children 12–59 months
5. Deworming during pregnancy

WASH

1. Improved water source (water source used at the household and community levels)
2. Treatment of water used for consumption (at the household level)
3. Handwashing (presence of handwashing facility, water, and soap at the household and community levels)
4. Access to improved sanitation (presence of latrines at the household and community levels)

REPRODUCTIVE HEALTH

1. Usage of modern methods of family planning (which is associated with increased birth spacing and reduced early child bearing)
2. Delayed cord clamping

AGRICULTURE

1. Promotion of micronutrient-rich and biofortified foods
2. Home food production

EDUCATION:

1. Deworming of children in schools
2. Hygiene education in schools

STEP 3: REVIEW INPUTS TO PRIORITIZATION

- Review DATA's six categories of barriers that contribute to successful program implementation
- Brainstorm additional, context-specific barriers that should be considered in the district's implementation of programs

DATA includes a framework for districts to follow to analyze how well a given intervention is working in the district context. By going through this process for each intervention, it should be possible to get a picture of what is working well, what is faltering, and what to focus on to improve the situation.

For each intervention, six program elements likely determine whether the intervention is effective.

1. Presence of a **policy** (without which the intervention is not likely to be implemented)
2. **Commodities**—adequate and consistent supply of the commodity required for the intervention
3. **Funding**—adequate and consistent allocation of resources to successfully implement an intervention
4. **Provider training**—adequate training of staff including refresher training and supportive supervision to ensure high quality of services
5. **Client Demand**—awareness and interest about the intervention in the target population
6. **Coverage**—the overall percentage of the target population receiving the intervention, which depends on demand and quality of service delivery

Other factors—These can include issues related to compliance, which captures the percentage of the target population practicing the intervention correctly, for example, taking all the IFA tablets, regularly handwashing, and using a household latrine.

Policy is usually determined at the national level, with districts adhering to national policy. Districts need to be aware of these policies. Districts are likely to have **commodity** information on outflow to health clinics. This can be useful to confirm that a needed commodity is available to service providers since without the commodity, it is not possible to provide the service. This is also related to the information available to the district on the **funding** that has been allocated to implement the intervention. The level of **funding**, in turn, determines the **training** given to staff, including refresher training and supportive supervision, to ensure high quality of services. Information related to funding and provider training is

available to the district managers. Districts are *not* likely to have information on **demand** for a specific intervention unless they have mechanisms to ask clients questions during clinic or household visits. Districts are also not likely to have population-based **coverage** information; however, they may have reported information that will give some idea about coverage. For example, in a country with a high ANC first visit rate, the percentage of these visits where IFA was provided can provide a proxy for a population-based coverage estimate. High coverage for an intervention implies there is demand for that service, while low coverage could be from lack of demand or from other factors. In this way, by using what information is available, it should be possible to "map" each intervention with regard to these program elements.

STEP 4: IDENTIFY AND ASSESS BARRIERS TO PROGRAM IMPLEMENTATION

- For each intervention, discuss barriers under DATA's six categories (and any other, context-specific barriers)
- Fill out the "Barriers" section of the Findings Dashboard

Many countries will have good programs for many of the listed interventions. Some countries will have the policies in place, but programmatic factors may be limiting the effectiveness of the intervention. Thus, it is a good exercise to analyze the different program elements that may limit effectiveness and those that may be able to be addressed at the district level.

For some interventions, there may not be a national policy, so the district is unable to introduce the intervention. For those interventions where policy exists, most involve a commodity (without the commodity, adequate coverage cannot be achieved). There must be a demand for the intervention. Staff providing the service must be motivated to do so, and the service must reach the full population, including the most vulnerable and hard to reach. Finally, the clients must be compliant in their use of the intervention, following the instructions of the service providers.

While this analytic process will help identify areas of weakness for an intervention, determining how best to overcome those weaknesses may not be easy. For example, if there are logistics supply issues for a critical commodity, but the supply is limited by the central-level distribution of the commodity, it may be difficult for the district to affect that shortcoming. Similarly, if coverage is low, this may be because of low demand or poor service delivery, each requiring different activities to try to improve the situation. Further analysis of the constraints to addressing these limitations may require a close look at care provider or caregiver needs. These needs include awareness, knowledge, information, and skills, commitment and motivation, resources, and support from others.

This analysis should help your district understand both the multiple causes of anemia and the complexity of the interventions to reduce anemia prevalence in women and children. Understanding some of the limitations and constraints will help you prioritize activities to strengthen programs in a way that is most likely to be effective.

Examining the data on prevalence of underlying causes and on the sectoral programs presented

in the DATA, certain patterns may emerge. For example, are there logistics supply issues for multiple interventions or only for one or two? The former implies an overall problem with the essential drug system—something that may need to be addressed at the central level. The latter implies that while the logistics system is working, selected commodities are not reaching facilities. Similarly, low coverage across many interventions suggests difficulty with service delivery—perhaps from lack of training, low motivation, or lack of support.

STEP 5: FORMULATE PLAN OF ACTION

- Develop a district plan of action for improved anemia prevention and control programming

Using the information in DATA as a starting point, district managers and workshop participants can determine whether there are broad systems issues (logistics, training, or supervision) or whether there are specific interventions that need special attention (refresher training, increased attention during annual meetings, or supportive supervision visits). Ideally, this analytic process will result in a modification of the district work plan to accommodate new activities directed at improving systems or specific interventions to reduce anemia. The following questions can guide the formulation of plans of action:

1. What can each sector do to improve the anemia situation in the district?
2. What activities and interventions should be prioritized within each sector?
3. How can identified barriers be addressed and what is required for the necessary actions to take place?

Part IV: Annotated Reference List

KEY REFERENCES PROVIDING THE EVIDENCE FOR INTERVENTIONS KNOWN TO REDUCE ANEMIA

Investing resources in reducing anemia is justified by the high prevalence of the condition and its consequences. Anemia is one of the most common health disorders. Globally, in 2011, anemia affected the lives of almost half a billion women of reproductive age and almost 300 million children under five years old. The problem of anemia is most widespread in Central Africa and West Africa, where 71 percent of children under five years old, 48 percent of non-pregnant women, and 56 percent of pregnant women are affected (Stevens et al. 2013).

The consequences of anemia have substantial negative effects on the health and economic well-being of nations and communities. Globally, iron-deficient anemia alone contributes to 115,000 maternal deaths and 591,000 perinatal deaths each year. For women with hemoglobin levels between 50 and 120 g/L (5–12 g/dL), increasing hemoglobin to 10 g/L (1 g/dL) will decrease the risk of maternal death by 20 percent (Stoltzfus, Mullany, and Black 2004). This analysis was updated recently for the 2013 Lancet Series, and the findings remained remarkably similar (Murray-Kolb 2012). Maternal anemia also increases pre-term delivery, low birthweight, and infant mortality. Further, it reduces cognitive development in children, which has important long-term effects on educational achievement (Black et al. 2013). Anemic adults have less energy than non-anemic adults and so they work less productively. Economists estimate that anemia reduces national production by $3.64 per capita or 0.81 percent of GDP (Horton and Ross 2003; Horton and Ross 2007).

The USAID-funded A2Z project has recommended six actions that policymakers can prioritize to strengthen action to reduce anemia (A2Z: The USAID Micronutrient and Child Blindness Project 2009). They are 1) increase political commitment; 2) increase integration of anemia-specific interventions with programs in the health and other sectors; 3) strengthen pharmaceuticals and supplies; 4) expand the involvement of communities; 5) increase demand for interventions; and 6) strengthen monitoring and evaluation.

In 2008, the Micronutrient Forum reviewed and analyzed the progress made on implementing anemia programs to date and the barriers and enablers encountered by country-level implementers. The report of that meeting summarized actions that program implementers can take to strengthen the impact of interventions to reduce anemia (Klemm et al. 2009).

In the following section, the interventions are organized by mechanism of action.

a. Those designed to improve iron intake and stores and reduce losses

b. Those designed to reduce infections and inflammation

Part A and B provide annotated evidence for some of the interventions under each mechanism of action, and list the official WHO policy, where available.

PART A. EVIDENCE FOR INTERVENTIONS THAT INCREASE IRON INTAKE, IMPROVE IRON STORES, AND REDUCE IRON LOSSES

1. Daily IFA supplementation during pregnancy
2. Delayed cord clamping
3. Appropriate complementary feeding (including frequency and diversity)
4. Vitamin A Supplementation for Children under Five
5. Multiple Micronutrient Powders (MNP) for 6–23 months old children
6. Intermittent IFA for adolescent girls (age 15–19) and women of reproductive age
7. Family planning to increase birth spacing
8. Nutrition-sensitive agricultural programs

1. Daily IFA Supplementation during Pregnancy

Iron requirements increase dramatically during pregnancy to meet the needs of the fetus and placenta. These increased requirements for iron cannot be met with diet alone, even when diets are rich in animal foods and other absorbable iron. High coverage and high compliance with IFA during pregnancy reduces anemia prevalence at term by 70 percent and iron deficiency at term by 57 percent (Peña-Rosas et al. 2012; Kulier et al. 1998; Sanghvi, Harvey, and Wainwright 2010). New evidence that infections limit iron absorption likely explains some of the difficulty in reducing anemia during pregnancy. It seems probable that concurrent efforts are needed to reduce infection and inflammation in this target group (Prentice et al. 2012).

Peña-Rosas, J. P., L. M. De-Regil, T. Dowswell, and F. E. Viteri. 2012. "Daily Oral Iron Supplementation during Pregnancy." *Cochrane Database of Systematic Reviews* 12: CD004736. doi: 10.1002/14651858.CD004736.pub4.

Kulier, R., M. de Onis, A. M. Gülmezoglu, and J. Villar. 1998. "Nutritional interventions for the Prevention of Maternal Morbidity." *International Journal of Gynecology and Obstetrics* 63(3): 231–246.

Sanghvi, T. G., P. W. J. Harvey, and E. Wainwright. 2010. "Maternal Iron-Folic Acid Supplementation Programs: Evidence of Impact and Implementation." *Food and Nutrition Bulletin* 31(2 Suppl): S100–7.

Prentice, Andrew M., Conor P. Doherty, Steven A. Abrams, Sharon E. Cox, Sarah H. Atkinson, Hans Verhoef, Andrew E. Armitage, and Hal Drakesmith. 2012. "Hepcidin Is the Major Predictor of Erythrocyte Iron Incorporation in Anemic African Children." *Blood* 119(8):1922–8.

WHO Policy:

WHO. 2012. "Guideline: Daily Iron and Folic Acid Supplementation in Pregnant Women." Geneva: WHO. http://apps.who.int/iris/bitstream/10665/77770/1/9789241501996_eng.pdf

2. Delayed Cord Clamping

Waiting before clamping the cord allows blood flow to continue between the mother and newborn for one to three minutes after birth or until the cord stops pulsing. This practice can be done while initiating simultaneous essential newborn care. Delayed cord clamping reduced anemia by 47 percent during the period from two to six months of age and built iron stores to last up to six months of age. Importantly, this intervention increased iron stores in low birthweight infants and infants of anemic mothers (Hutton and Hassan 2007; Chaparro et al. 2006).

Hutton, Eileen K., and Eman S. Hassan. 2007. "Late vs. Early Clamping of the Umbilical Cord

in Full-term Neonates: Systematic Review and Meta-analysis of Controlled Trials." *JAMA* 297(11): 1241–52.

Chaparro, C. M., L. M. Neufeld, G. Tena Alavez, R. Eguia-Líz Cedillo, and K. G. Dewey. 2006. "Effect of Timing of Umbilical Cord Clamping on Iron Status in Mexican Infants: A Randomised Controlled Trial." *The Lancet* 367:1997-2004.

WHO Policy:

WHO, and USAID. MCHIP. Delayed cord clamping of the umbilical cord to prevent infant anemia. http://www.mchip.net/sites/default/files/PPH%20Briefer%20%28DCC%29.pdf (accessed September 29, 2014)

WHO. "Optimal Timing of Cord Clamping for the Prevention of Iron Deficiency Anemia in Infants." Geneva: WHO. http://www.who.int/elena/titles/cord_clamping/en/ (accessed June 23, 2014).

WHO. 2012. "Guidelines on Basic Newborn Resuscitation." Geneva: WHO. http://www.who.int/maternal_child_adolescent/documents/basic_newborn_resuscitation/en/

3. Appropriate complimentary feeding (including frequency and diversity)

Complementary feeding is the process starting at 6 months when breast milk alone is no longer sufficient to meet the nutritional requirements of an infant and when other foods and liquids are needed along with breast milk. There is strong consensus that appropriate complementary feeding is critical to all aspects of the nutrition and health of the infant. Evidence on the impact of complementary feeding on reducing anemia was restricted to specific components of these interventions such as multiple micronutrient powders and specifically fortified complementary food products. This evidence is described below.

WHO Policy:

WHO. The World Health Organization recommendation on infant feeding. Geneva, 2001. http://www.who.int/nutrition/topics/infantfeeding_recommendation/en/"

4. Vitamin A Supplementation for Children under Five

Vitamin A deficiency can interfere with iron transport in the body and production of red blood cells. Vita¬min A deficiency is associated with anemia because the underlying nutrition and diet factors that cause them are similar (Bloem 1995). However, the evidence for reducing anemia through vitamin A supplementation is equivocal.

Bloem, Martin W. 1995. "Interdependence of Vi¬tamin A and Iron: An Important Association for Programmes of Anaemia Control." Proceedings of the Nutrition Society 54(2):501–8.

WHO Policy:

WHO. 2011. "Guideline: Vitamin A Supplementation in Infants and Children 6–59 Months of Age." Geneva: WHO. http://www.ncbi.nlm.nih.gov/books/NBK185172/pdf/TOC.pdf

5. MNP for 6–23 Months Old Children

MNP contain a mix of micronutrients in powder form that are packaged in single-dose sachets. They can be added directly to any semi-solid complementary food prepared in the household without substantially affecting taste or color of the food. Iron and other essential micronutrients, such as zinc; iodine; vitamins A, C, and D; and B vitamins, may be added

to the MNP sachets. Evidence from efficacy studies conducted in different parts of the world suggest that MNP are as efficacious as iron drops in reducing and preventing anemia when added to complementary foods, reducing anemia by 31 percent and reducing iron deficiency by 51 percent (De-Regil et al. 2011; UNICEF-CDC and HF-TAG 2013). The intervention is efficacious among infants and young children 6–23 months of age living with varying anemia and malaria prevalence. The duration of the intervention did not impact the effectiveness It is essential to position anemia-specific interventions such as MNP wholly within the context of improving complementary feeding behaviors overall.

De-Regil, L. M., P. S. Suchdev, G. E. Vist, S. Walleser, and J. P. Peña-Rosas. 2011. "Home Fortification of Foods with Multiple Micronutrient Powders for Health and Nutrition in Children Under Two Years of Age." *Cochrane Database of Systematic Reviews* (9):CD008959.

UNICEF-CDC. Global Assessment of Home Fortification Interventions, 2011. Geneva: Home Fortification Technical Advisory Group, 2013. http://www.hftag.org/resource/global-assessment-of-home-fortification-interventions-2011-pdf/.

WHO Policy:

WHO. 2011. "Guideline: Use of Multiple Micronutrient Powders for Home Fortification of Foods Consumed by Infants and Children 6–23 Months of Age." Geneva: WHO. http://apps.who.int/iris/bitstream/10665/44651/1/9789241502047_eng.pdf?ua=1

6. Intermittent IFA for Adolescent Girls (age 15–19) and Women of Reproductive Age

The onset of menstruation almost doubles the amount of iron required to meet needs. Weekly IFA supplementation for adolescent girls has been shown to substantially reduce prevalence of anemia. The largest of these programs was undertaken in seven states in India where baseline prevalence ranged from 54 percent to 99 percent. The decrease in anemia prevalence reported after one year varied from 8 to 50 percentage points. A reduction of 70 percentage points was measured in one program that lasted two years (Dwivedi and Schultink 2005).

Dwivedi, Archana, and Werner Schultink. "Reducing Anemia among Indian Adolescent Girls through Once-Weekly Supplementation with Iron and Folic Acid." SCN News 31:19-23. http://www.unsystem.org/scn/Publications/SCNNews/scnnews31.pdf

WHO Policy:

WHO. 2009. "Weekly Iron-Folic Acid Supplementation (WIFS) in Women of Reproductive Age: Its Role in Promoting Optimal Maternal and Child Health." Geneva: WHO. http://www.who.int/nutrition/publications/micronutrients/weekly_iron_folic_acid/en/index.html

7. Family Planning to Increase Birth Spacing

Inadequate birth spacing would be expected to cause iron deficiency and anemia, as well as undernutrition more broadly, but the evidence is stronger for an impact on the growth of children than it is for anemia. One study reported a 30 percent increase in risk of anemia for pregnancies spaced less than six months (Conde-Agudelo and Belizán 2000). Two other studies found no difference in anemia rates with shorter birth intervals (Dewey and Cohen 2007). There is substantial overlap between the contact points for the delivery of family planning services and nutrition services. A working group of experts in both maternal, infant, and young child nutrition (MIYCN) and family planning

(FP) has created a toolkit. The toolkit presents a framework for linking MIYCN with FP to improve maternal, infant, and child health outcomes (USAID et al. 2014).

Conde-Agudelo, Agustin, and Jose M. Belizan. 2000. "Maternal Morbidity and Mortality Associated with Interpregnancy Interval: Cross Sectional Study." *BMJ* 321(7271): 1255–9.

Dewey, Kathryn G., and Roberta J. Cohen. 2007. "Does Birth Spacing Affect Maternal or Child Nutritional Status? A Systematic Literature Review." *Maternal & Child Nutrition 3* (3):151–73.

USAID, MCHIP, Institute for Reproductive Health, ACCESS, World Vision, IYCN. 2011. "Maximizing Synergies between Maternal, Infant, and Young Child Nutrition and Family Planning: A Summary of Key Global Evidence." Baltimore. Knowledge for Health (K4Health) Project http://www.k4health.org/sites/default/files/MIYCNTechBrief_Final.pdf

8. Nutrition-Sensitive Agricultural Programs

The agricultural sector impact on anemia is felt indirectly through programs at the production level that serve to improve yield and revenues and consequently improve the dietary diversity and micronutrient intake of households. The agricultural sector helps farmers grow micronutrient-rich and biofortified food crops via agricultural extension services and farmer field schools; At the household level, it helps by supporting home garden programs to grow micronutrient-rich and biofortified foods and animal husbandry projects to improve the livelihood security. This leads to improved nutrition, thus increasing intake of micronutrient-rich and biofortified foods (Food and Agriculture Organization of the United Nations 2013a).

In addition to increasing availability, affordability, and consumption of diverse, safe, nutritious foods and diets, these interventions have to be aligned with dietary recommendations and environmental sustainability (Food and Agriculture Organization of the United Nations 2013b).

FAO. 2013. "The State of Food and Agriculture 2013." Rome: FAO. http://www.fao.org/docrep/018/i3300e/i3300e.pdf

FAO. 2013. "Synthesis of Guiding Principles on Agriculture Programming for Nutrition." Rome: FAO. http://www.fao.org/docrep/017/aq194e/aq194e.pdf

PART B. EVIDENCE FOR INTERVENTIONS THAT REDUCE INFECTIONS AND INFLAMMATION

1. Early initiation of breastfeeding and exclusive breastfeeding through six months
2. Malaria preventive treatment in pregnant women, malaria prevention with bed nets, and indoor residual spraying
3. Deworming children 12–59 months and school age children
4. Deworming during pregnancy
5. WASH interventions, including handwashing (among mothers, older children—as a family practice); access to clean water (both household and community sources); and improved sanitation (presence and use of latrines at the household and community levels)

1. Early initiation of breastfeeding and exclusive breastfeeding through six months:

Early initiation of breastfeeding (within 24 hours but programmatically within 1 hour) provides benefits for the infant and mother. Early initiation reduces

infection, saves lives, helps establish breastfeeding, fosters bonding between mother and child, and reduces the risk of maternal postpartum hemorrhage (Begum and Dewey 2010). The impact of early initiation alone on anemia has not been quantified. However, the causal pathways by which early initiation reduces infections and accompanying inflammation are well established (Begum and Dewey 2010), and will indirectly reduce anemia.

Studies in Ghana and Nepal determined that delaying the initiation of breastfeeding for more than 24 hours increased newborn mortality by 160 percent and 40 percent, respectively (Edmond et al. 2007; Mullany et al. 2008). In Ghana, researchers established that the lower neonatal mortality resulted almost exclusively from reduced infectious disease. The 2008 Lancet Series compiled compelling evidence that increasing the number of babies who are breastfed optimally will dramatically improve nutrition status, reduce the prevalence of infection, and reduce child mortality (Black et al. 2008).

Begum, Khadija, and Kathryn G. Dewey. 2010. "Impact of Early Initiation of Exclusive Breastfeeding on Newborn Deaths." Washington, DC: Alive and Thrive. http://www.aliveandthrive.org/sites/default/files/Insight%20Issue%201%20Impact%20of%20early%20initiation_English_test2.pdf

Edmond, Karen M., Betty R. Kirkwood, Seeba Amenga-Etego, Seth Owusu-Agyei, and Lisa S. Hurt. 2007. "Effect of Early Infant Feeding Practices on Infection-Specific Neonatal Mortality: An Investigation of the Causal Links with Observational Data from Rural Ghana." *The American Journal of Clinical Nutrition* 86 (4):1126–31.

Mullany, Luke C., Joanne Katz, Yue M. Li, Subarna K. Khatry, Steven C. LeClerq, Gary L. Darmstadt, and James M. Tielsch. 2008. "Breast-Feeding Patterns, Time to Initiation, and Mortality Risk among Newborns in Southern Nepal." *The Journal of Nutrition* 138 (3):599–603.

Black, Robert E., Lindsay H. Allen, Zulfiqar A. Bhutta, Laura E. Caulfield, Mercedes de Onis, Majid Ezzati, Colin Mathers, and Juan Rivera. 2008. "Maternal and Child Undernutrition: Global and Regional Exposures and Health Consequences." *The Lancet* 371 (9608): 243–260.

WHO Policy:

WHO. 2001. "Global Strategy for Infant and Young Child Feeding: The Optimum Duration of Exclusive Breastfeeding." Geneva: WHO. http://apps.who.int/gb/archive/pdf_files/WHA54/ea54id4.pdf?ua=1

2. Malaria Preventive Treatment in Pregnant Women, Malaria Prevention with Bed Nets (Insecticide-treated Nets [ITN]; Long Lasting Insecticide-treated nets [LLIN]), and Indoor Residual Spraying (IRS):

Where malaria is prevalent, it is a major cause of anemia. Intermittent preventive treatment (IPTp) involved providing all pregnant women with at least two preventive treatment doses of an effective antimalarial drug during routine ANC visits. In Malawi, IPT reduced placental infections by 30 percent and halved the number of low birthweight babies. Insecticide-treated nets (ITNs) and long-lasting insecticide-treated nets (LLIN) decrease both the number of malaria cases and malaria death rates in pregnant women and their children. Effective use of ITNs by women in a Kenyan study demonstrated a 25 percent reduction in babies who were underweight or premature (Roll Back Malaria 2014). IRS is a proven and highly effective malaria control measure; it involves the coordinated, timely spraying of the interior walls of homes with insecticides. Mosquitoes are killed when they rest on the walls. Sprayed houses are protected for about 4 to 10 months, depending on the insecticide used and the housing construction. In a summary of studies that focused on children in African countries, effective malaria control improved mean hemoglobin by 7.6 g/L, reduced anemia by 27 percent, and reduced severe anemia by 60 percent (Korenromp et al. 2004).

Roll Back Malaria. "Malaria in Pregnancy." Geneva: WHO. http://www.rbm.who.int/cmc_upload/0/000/015/369/RBMInfosheet_4.htm

Korenromp, Eline L., Joanna R. Armstrong-Schellenberg, Brian G. Williams, Bernard L. Nahlen, and Robert W. Snow. 2004. "Impact of Malaria Control on Childhood Anaemia in Africa–A Quantitative Review." Tropical Medicine & International Health 9 (10): 1050–65.

3. Deworming Children 12–59 Months and School Age Children

Hookworm and other worms can lead to gastrointestinal blood loss, poor nutrient absorption, inhibition/suppression of appetite, and general inflammation. Inflammation can aggravate iron deficiency and anemia in children. Deworming children older than 12 months has increased rapidly over the last decade. Ten years ago, this intervention was incorporated with vitamin A supplementation into packages of preventive services being delivered twice each year through Child Health Weeks/Days. This approach is now recommended by WHO. Reaching deworming treatment to school-age children through schools allows for higher program efficiency, better adherence to the medicine, and provides an opportunity to reach nonenrolled school-age children through their enrolled counterparts.

Evidence indicates that universal deworming improves hemoglobin concentrations in children by a small amount (1–2 g/L) (Hall et al. 2008; Gulani et al. 2007). This increase in hemoglobin depends on the types of worms, as well as the prevalence and intensity of infections. Increasing hemoglobins by deworming will reduce the prevalence of anemia by about 5 percent.

Some controversy exists regarding whether universal deworming of children is effective. A recent Cochrane review concluded there was no sufficient evidence to justify universal deworming (Taylor-Robinson et al. 2012). Procedures used in the Cochrane analysis may deem an intervention ineffective at the population level, but not explore the intervention's critical importance to a highly affected subpopulation. In each country, national policymakers determine whether universal deworming is appropriate for the context of their country.

Hall, Andrew, Gillian Hewitt, Veronica Tuffrey, and Nilanthi de Silva. 2008. "A Review and Meta-Analysis of the Impact of Intestinal Worms on Child Growth and Nutrition." *Maternal and Child Nutrition 4* (Suppl 1): 118–236.

Gulani, Anjana, Jitender Nagpal, Clive Osmond, and H. P. S. Sachdev. 2007. "Effect of Administration of Intestinal Anthelmintic Drugs on Haemoglobin: Systematic Review of Randomised Controlled Trials." BMJ 334: 1095. doi:10.1136/bmj.39150.510475.AE

Taylor-Robinson, D. C., N. Maayan, K. Soares-Weiser, S. Donegan, and P. Garner. 2012. "Deworming drugs for soil-transmitted intestinal worms in children: Effects on nutritional indicators, haemoglobin and school performance." Cochrane Database of Systematic Reviews. 7: CD000371.

WHO Policy:

WHO. 2006. "Preventive Chemotherapy in Human Helminthiasis. Coordinated Use of Anthelminthic Drugs in Control Interventions: A Manual for Health Professionals and Programme Managers." Geneva: WHO. http://whqlibdoc.who.int/publications/2006/9241547103_eng.pdf

WHO. 2005. "Deworming for Health and Development." Geneva: WHO. http://whqlibdoc.who.int/hq/2005/who_cds_cpe_pvc_2005.14.pdf

WHO. 2011. Helminth control in school age children: a guide for managers of control programmes - 2nd ed. Geneva: WHO. http://apps.who.int/iris/bitstream/10665/44671/1/9789241548267_eng.pdf

4. Deworming during Pregnancy

As in children, hookworm infection during pregnancy can lead to gastrointestinal blood loss, poor nutrient absorption, inhibition/suppression of appetite, and inflammation. Inflammation increases the prevalence of iron deficiency and anemia in pregnancy. WHO recommends providing deworming medications, such as albendazole and mebendazole, beginning in the second trimester of pregnancy, as a routine part of ANC visits. Deworming in pregnancy has resulted in reductions in the prevalence of anemia between 1 percent and 12 percent (Gulani et al. 2007). Other researchers reported that intervention studies showed a benefit of deworming for maternal health, but they did not quantify this impact. These authors reported that women with even light infections had hemoglobins that were significantly lower (0.24 g/L) than those without infections (Brooker, Hotez, and Bundy 2008).

Gulani, Anjana, Jitender Nagpal, Clive Osmond, and H. P. S. Sachdev. 2007. "Effect of Administration of Intestinal Anthelmintic Drugs on Haemoglobin: Systematic Review of Randomised Controlled Trials." BMJ 334: 1095. doi:10.1136/bmj.39150.510475.AE

Brooker, Simon, Peter J. Hotez, and Donald A. P. Bundy. 2008. "Hookworm-Related Anaemia among Pregnant Women: A Systematic Review." *PLoS Neglected Tropical Diseases*. doi:10.1371/journal.pntd.0000291.

WHO Policy: Same documents as for children above, except the guidance for school age children.

5. Water, Sanitation, and Hygiene Interventions

Basic hygiene reduces the risk of infection, thereby reducing nutritional losses incurred by infection. Cutting the risk of infection also reduces inflammation,

which suppresses hemoglobin formation. Handwashing in older infants reduces infection risk and improves nutritional status as effectively as it does with their mothers. Availability of water for handwashing is key to promoting these behaviors. Evidence gathered by WHO indicates that diarrhea rates have been reduced by five percent for water supply at source, 19 percent for water quality interventions, 36 percent for sanitation interventions, and 47 percent for handwashing with soap (World Health Organization 2011). It is not known at this time the extent to which these interventions will reduce anemia.

WHO. 2011. "Water, Sanitation and Hygiene Interventions and the Prevention of Diarrhoea: Biological, Behavioural and Contextual Rationale." Geneva: WHO. http://www.who.int/elena/titles/bbc/wsh_diarrhoea/en/

References

A2Z: The USAID Micronutrient and Child Blindness Project. 2009. Maternal anemia control: What health policymakers can do. Washington, D.C.: A2Z Project. http://a2zproject.org/pdf/Final_Maternal_Anemia_Brief_for_Web.pdf.

Black, R. E., et al. 2013. Maternal and child undernutrition and overweight in low-income and middle-income countries. *The Lancet* 382(9890): 427-51.

Horton, S., and J. Ross. 2003. "The Economics of Iron Deficiency." *Food Policy* 28: 51–75.

Horton, S., and J. Ross. 2007. "Corrigendum to: "The Economics of iron deficiency" [Food Policy 28 (2003) 51–75]." *Food Policy* 32: 141-3.

Klemm, Rolf D. W., Philip W. J. Harvey, Emily Wainwright, Silvana Faillace, and Emorn Wasantwisut. 2009. "Scaling Up Micronutrient Programs: What Works and What Needs More Work? The 2008 Innocenti Process." Washington, DC: Micronutrient Forum. http://a2zproject.org/pdf/Innocenti_Report.pdf.

Murray-Kolb, Laura E. 2012. "CHERG Iron Report: Maternal Mortality, Child Mortality, Perinatal Mortality, Child Cognition, and Estimates of Prevalence of Anemia Due to Iron Deficiency." Baltimore: CHERG. http://cherg.org/publications/iron-report.pdf (accessed June 20, 2014)

Stevens, Gretchen A., Mariel M. Finucane, Luz Maria De-Regil, Christopher J. Paciorek, Seth R. Flaxman, Francesco Branca, Juan Pablo Peña-Rosas, Zulfiqar A Bhutta, and Majid Ezzati. 2013. "Global, Regional, and National Trends in Haemoglobin Concentration and Prevalence of Total and Severe Anaemia in Children and Pregnant and Non-pregnant Women for 1995–2011: A Systematic Analysis of Population-Representative Data." The Lancet Global Health (1) 1: e16-25.

Stoltzfus, Rebecca J., Luke Mullany, and Robert E. Black. 2004. "Iron Deficiency Anaemia." In *Comparative Quantification of Health Risks: Global and Regional Burden of Disease Attributable to Selected Major Risk Factors*, edited by Majid Ezzati, Alan D. Lopez, Anthony Rodgers, and Christopher J. L. Murray.,163–209. Geneva: WHO.

Weatherall, D.J. 2008. "Hemoglobinopathies worldwide: present and future." *Current Molecular Policy* 8 (7): 592–9.

SPRING
JSI Research & Training Institute, Inc.
1616 Fort Myer Drive, 16th Floor
Arlington, VA 22209 USA

Tel: 703-528-7474
Fax: 703-528-7480

Email: info@spring-nutrition.org
Web: www.spring-nutrition.org

SPRING
Strengthening Partnerships, Results, and Innovations in Nutrition Globally