



# Anemia Prevention and Control: **WHAT WORKS**

Part I  
Program Guidance



The World Bank



unicef



The  
Micronutrient  
Initiative



Anemia Prevention  
and Control:  
**WHAT WORKS**

---

**Part I**  
Program Guidance

The opinions expressed herein are those of the author(s) and do not necessarily reflect the views of USAID.

The findings, interpretations, and conclusions expressed here are those of the author(s) and do not necessarily reflect the views of the Board of Executive Directors of the World Bank or the governments they represent. The World Bank cannot guarantee the accuracy of the data included in this work. The boundaries, colors, denominations, and other information shown on any map in this work do not imply on the part of the World Bank any judgment of the legal status of any territory or the endorsement or acceptance of such boundaries.

The views expressed in this publication are those of the author(s) and do not necessarily reflect the views of UNICEF. Any map in this work does not reflect a position by UNICEF on the legal status of any country or territory or the delimitation of any frontiers.

This document does not necessarily represent the views or opinions of the Pan American Health Organization (PAHO).

The views expressed in this publication are those of the author(s) and do not necessarily reflect the views of the Food and Agriculture Organization (FAO) of the United Nations. The designations employed and the presentation of material do not imply the expression of any opinion whatsoever on the part of FAO concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. The designations “developed” and “developing” economies are intended for statistical convenience and do not necessarily express a judgement about the stage reached by a particular country or area in the development process.

The views in this document do not necessarily reflect the views expressed or promoted by the Micronutrient Initiative.

The Monitoring, Evaluation, and Design Support (MEDS) project coordinated the development and production of this document. MEDS is funded by USAID under contract no. HRN-I-02-99-0002-00, task order no. 02. LTG Associates, Inc., and TvT Global Health and Development Strategies™, a division of Social & Scientific Systems, Inc., implement the project.

The Population, Health and Nutrition Information (PHNI) Project produced this document. PHNI is funded by USAID under contract no. HRN-C-00-00-00004-00. The Project is managed by Jorge Scientific Corporation with The Futures Group International and John Snow, Inc.

ISBN .....

June 2003

# Anemia Prevention and Control: What Works

## *Contents*

### Part I: Program Guidance

---

<b>Preface</b> .....	5
<b>Acknowledgments</b> .....	7
<b>Abbreviations and Acronyms/Units of Measure</b> .....	9
<b>Introduction</b> .....	11
<b>Chapter I</b> Anemia: “Lost Years of Healthy Life” .....	15
<b>Chapter II</b> Taking Action: Developing a Strategy for Anemia Prevention and Control .....	25
<b>Chapter III</b> Providing Iron Supplements to Combat Anemia .....	45
<b>Chapter IV</b> Improving Dietary Iron Intake to Combat Anemia .....	59
<b>Photo and Illustration Credits</b> .....	75

### Part II: Tools and Resources

---

The contents of **Anemia Prevention and Control: What Works, Part II: Tools and Resources** are listed below. See the Part II Contents for page numbers.

#### **Statistics/Technical Data**

Hemoglobin and Hematocrit Values Defining Anemia at Sea Level

Shifting the Hemoglobin Distribution: Hemoglobin Distribution in  
Palestinian vs American Children and Women

Anemia Prevalence Rates in Vulnerable Populations, Selected Countries

Anemia Prevalence by Rural/Urban Residence, Selected Countries

Substances That Inhibit and Enhance Absorption of Iron

Demands for Iron in Pregnancy

Proportion of Women Utilizing Antenatal Care (ANC) Services and  
Receiving/Taking Iron or Iron-Folic Acid (IFA) Supplements, Selected  
Countries

## **Program Development**

Raising Awareness/Program Advocacy: Sample Fact Sheets

Selected Monitoring and Evaluation Indicators for Anemia Prevention and Control Programs

A Tool for Reviewing Micronutrient Programs

Qualitative Research Instrument on Perceptions of Anemia and Use of Iron Supplements – The Indramayu Project, Indonesia

Recommended Intermittent Presumptive Treatment (IPT) or Treatment Regimens for Malaria, Hookworm, and Schistosomiasis

## **Iron Supplementation/Food Fortification**

Iron Doses and Three-Month Hemoglobin Increase in Women

Iron and Folic Acid Doses for Universal Supplementation in Vulnerable Groups

Iron and Folic Acid Doses for Treating Severe Anemia in Vulnerable Groups

United States Dietary Reference Intakes for Anemia-Related Micronutrients (Other Than Iron and Folic Acid) for Vulnerable Groups

Counseling Pregnant Women and Mothers About Iron Supplements

Negotiating With Women to Follow Advice

Food Fortification: Seven Steps for Quality Control

## **Information Sources for Anemia Prevention and Control**

## **References (to Parts I and II)**

## Preface

---

### ***Anemia Prevention and Control:***

***What Works*** has two purposes:

1. To bring to the attention of program and project managers of health and related activities the serious negative consequences of anemia for the health and physical, mental, and economic productivity of individuals and populations
2. To make managers aware of the various approaches to anemia prevention and control they can take in policies and programs in the health and health-related sectors

***Anemia Prevention and Control: What Works*** has two parts, ***Part I: Program Guidance*** and ***Part II: Tools and Resources***. Because anemia has multiple causes, ***Program Guidance*** advocates a coordinated strategy that takes a number of sector approaches to reducing anemia's prevalence and effects. It provides guidance on important issues and components that need attention in the design and implementation of anemia prevention and control strategies and programs. ***Tools and Resources*** is a compilation of anemia-related data, survey instruments, program materials, and references that managers can use to design and monitor programs.

In ***Program Guidance***, this **Preface** is followed by **Acknowledgments**, **Abbreviations and Acronyms/Units of Measure**, and an **Introduction** to anemia. The remainder of ***Part I*** is organized as follows:

***Chapter I, Anemia: "Lost Years of Healthy Life,"*** defines anemia; describes its impact, prevalence, and causes; and communicates the critical importance of taking action against anemia.

***Chapter II, Taking Action: Developing a Strategy for Anemia Prevention and Control,*** discusses good practices for strategy and program development and presents sector-specific interventions in health and related sectors for preventing and controlling anemia.

***Chapters III and IV*** then cover the good practices associated with augmenting dietary iron by providing iron supplements and through food fortification, two important interventions for addressing iron-deficiency anemia.

Each chapter includes a **Country Example** describing anemia prevention and control programming in a country that has incorporated many of the elements discussed in this document. In ***Chapters II, III, and IV,*** the country example follows a brief introduction to the section. A **Good Practices Checklist** gives the steps to take in designing and implementing programs, and the **Good Practices in Detail** section then describes the specific actions involved with these steps. The real-life experiences of many anemia prevention and control programs are highlighted in shaded text boxes to illustrate how the information provided in ***Program Guidance*** can be put to use. Italicized references directing readers to relevant materials in ***Tools and Resources*** also appear throughout the text.

### **Interagency Anemia Steering Group**

Wilma B. Freire  
Pan American Health Organization

Samuel G. Kahn  
U.S. Agency for International  
Development

Judith McGuire  
World Bank

Glenn L. Post  
U.S. Agency for International  
Development



## Acknowledgments

---

**Anemia Prevention and Control: What Works** was written by Rae Galloway, whose time was generously funded by the U.S. Agency for International Development (USAID), the Micronutrient Initiative (MI), and the World Bank. Ms. Galloway received technical advice and support from the Interagency Anemia Steering Group (IASG) composed of Wilma B. Freire, Pan American Health Organization (PAHO); Samuel G. Kahn, USAID; Judith McGuire, World Bank; and Glenn L. Post, USAID. The IASG defined the objectives and audience of **Anemia Prevention and Control: What Works**, identified reviewers, and gave essential comments at each step. Decisions about final content were made by the IASG.

Special thanks go to Milla McLachlan, nutrition adviser at the World Bank, for supporting this project, and Miriam Labbok, who as chief of nutrition and maternal/infant health at USAID's Bureau for Global Programs, Field Support and Research, helped define objectives and, after moving to the United Nations Children's Fund (UNICEF), reviewed the document.

### Adjunct Steering Group

Adjunct organizations were partners in this process and gave comments when objectives were defined and when reviewing the document. The adjunct organizations included the MI, UNICEF, the Canadian International Development Agency (CIDA), the United Nations Food and Agriculture Organization (FAO), the United Nations Standing Committee on Nutrition (SCN), and the World Health Organization (WHO).

### Country Contributors

The **Country Examples** that appear in **Part I: Program Guidance** are based on case studies of anemia prevention and control programs in Bolivia, Indonesia, Thailand, and Venezuela. These case studies were essential to this document. The Bolivia

example was written by the author of this document using a report prepared by consultant Maria Eugenia Lopez for the World Bank and the MI. The Indonesia example was written by Endang Achadi and D.M. Utari, University of Indonesia; the Thailand example by Pattanee Winichagoon, Mahidol University; and the Venezuela example by Maria Garcia-Casal, Instituto Venezolana de Investigaciones Cientificas (IVIC). The Bolivian, Indonesian, and Thai studies were made possible with funding from the MI. The information on poverty and anemia prevalence was prepared by Krishna Rao, consultant for a larger study funded by the MI for the World Bank. In addition, Ritujit Chhabra at the World Bank helped in checking prevalence data for the document.

### Review and Comments

Comments were given by adjunct organizations, external reviewers, and USAID on drafts of the document. The adjunct reviewers were Bruno de Benoist (WHO), Barbara MacDonald (CIDA), M. G. Venkatesh Mannar (MI), Ellen Muehlhoff (FAO), and Sonya Rabeneck (SCN).

External reviewers providing comments were Lawrence Barat, World Bank/Centers for Disease Control and Prevention (CDC) of the United States, on malaria; Lena Davidson, International Nutritional Anemia Consultative Group (INACG), technical/scientific aspects for the whole document; Patrick Friel, United Nations Development Programme (UNDP), family planning; Victor Fulgoni, consultant, technical/scientific aspects; Marito Garcia, World Bank, early childhood development; Marcia Griffiths, the Manoff Group, technical/scientific aspects; Richard Hurrell, Swiss Federation Institute of Technology, technical/scientific aspects; Judiann McNulty, Cooperative for Assistance and Relief Everywhere, Inc. (CARE), operational issues; Ibrahim Parvanta, CDC, technical/scientific aspects; Peter Ranum, consultant, technical/scientific aspects related to fortification; and Rebecca Stoltzfus, Cornell University, technical/scientific aspects.

USAID/Washington staff providing comments included Eunyong Chung, Carter Diggs, Mary Ettling, Miriam Labbok (now with UNICEF), Margaret Neuse, Patricia Stephenson, Joyce Turk, and Emily Wainwright. Victor Masbayi of USAID/Kenya and Kerry Pelzman of USAID/Russia also provided comments.

Staff from USAID-funded programs providing comments included Suzanne Harris, the International Life Sciences Institute (ILSI); staff from Micronutrient Operational Strategies and Technologies (MOST); and Sandra Remancus, Food and Nutrition Technical Assistance (FANTA).

### **Coordination, Editing, and Production**

This document is the result of a multi-agency effort coordinated and facilitated by staff of the Monitoring, Evaluation and Design Support (MEDS) project with funding from the USAID Bureau for Global Health. The Population, Health and Nutrition Information (PHNI) Project, also funded by the Bureau for Global Health, provided editorial and design staff and produced the document. Karen Lombardi (MEDS) and Chris Wharton (PHNI) edited the document. Muthoni Njage (MEDS) provided research and review assistance. Matthew Baek (PHNI) designed and formatted the document. The Government of the Netherlands provided funding to the World Bank to cover some printing costs.

## Abbreviations and Acronyms

---

<b>ACC/SCN</b>	Administrative Committee on Coordination, Sub-Committee on Nutrition (United Nations)
<b>AED</b>	Academy for Educational Development
<b>AIDS</b>	acquired immunodeficiency syndrome
<b>ANC</b>	antenatal care
<b>BASICS</b>	Basic Support for Institutionalizing Child Survival (Project)
<b>BF</b>	breastfeeding
<b>CARE</b>	Cooperative for Assistance and Relief Everywhere
<b>CDC</b>	Centers for Disease Control and Prevention (United States)
<b>CF</b>	complementary foods
<b>CIDA</b>	Canadian International Development Authority
<b>DHS</b>	Demographic and Health Survey
<b>ECD</b>	early childhood development
<b>EDTA</b>	ethylene diamine tetra-acetate
<b>FANTA</b>	Food and Nutrition Technical Assistance (Project)
<b>FAO</b>	Food and Agriculture Organization (United Nations)
<b>FGD</b>	focus group discussion
<b>GTZ</b>	Deutsche Gesellschaft für Technische Zusammenarbeit (German Technical Cooperation)
<b>Hb</b>	hemoglobin
<b>hct</b>	hematocrit
<b>HIV</b>	human immunodeficiency virus
<b>IASG</b>	Interagency Anemia Steering Group
<b>IDRC</b>	International Development Research Centre
<b>IEC</b>	information, education, and communication
<b>IFA</b>	iron-folic acid
<b>ILSI</b>	International Life Sciences Institute
<b>IMCI</b>	Integrated Management of Childhood Illness
<b>INACG</b>	International Nutritional Anemia Consultative Group
<b>IPT</b>	intermittent presumptive treatment (malaria)
<b>IUD</b>	intrauterine device

<b>IVIC</b>	Instituto Venezolana de Investigaciones Cientificas
<b>LAM</b>	Lactional Amenorrhea Method
<b>MEDS</b>	Monitoring, Evaluation and Design Support (Project)
<b>MI</b>	Micronutrient Initiative
<b>MOH</b>	ministry of health
<b>MOST</b>	Micronutrient Operational Strategies and Technologies (Project)
<b>NGO</b>	nongovernmental organization
<b>NHHS</b>	National Household Survey (Indonesia)
<b>NID</b>	national immunization day
<b>OMNI</b>	Opportunities for Micronutrient Interventions (Project)
<b>PAHO</b>	Pan American Health Organization
<b>PATH</b>	Program for Appropriate Technology in Health
<b>PHNI</b>	Population, Health and Nutrition Information (Project)
<b>SCN</b>	Standing Committee on Nutrition (United Nations)
<b>TBA</b>	traditional birth attendant
<b>TIPS</b>	Trials of Improved Practices
<b>TT</b>	tetanus toxoid
<b>USAID</b>	United States Agency for International Development
<b>UNICEF</b>	United Nations Children's Fund
<b>UNDP</b>	United Nations Development Programme
<b>UNU</b>	United Nations University
<b>VAD</b>	vitamin A deficiency
<b>WHO</b>	World Health Organization

## Units of Measure

---

<b>dL</b>	deciliter
<b>g</b>	gram
<b>kg</b>	kilogram
<b>L</b>	liter
<b>mcg</b>	microgram
<b>mg</b>	milligram
<b>mL</b>	milliliter

## Introduction

---

Anemia is defined as a low level of hemoglobin in the blood, as evidenced by a reduced quality or quantity of red blood cells. It has serious negative consequences, including increased mortality in women and children, decreased capacity to learn, and decreased productivity in all individuals. Its devastating effects on health and physical and mental productivity affect quality of life and translate into significant economic losses for individuals and for countries with high anemia prevalence.

Anemia is one of the world's most widespread health problems. It affects more than 2 billion people worldwide – one-third of the world's population – and is a significant public health problem throughout the developing world. In almost all developing countries, between one-third and one-half of the female and child populations are anemic. Prevalence among pregnant women and children under 2 years of age (the groups at highest risk) is typically more than 50 percent. In a 2002 report, the World Health Organization lists iron deficiency, a major cause of anemia, as one of the top 10 risk factors in developing countries for “lost years of healthy life.”

Anemia has multiple causes. Its direct causes can be broadly categorized as poor, insufficient, or abnormal red blood cell production; excessive red blood cell destruction; and excessive red blood cell loss. Contributing causes include poor nutrition related to dietary intake, dietary quality, sanitation, and health behaviors; adverse environmental conditions; lack of access to health services; and poverty. The relative importance of these causes varies by region.

Iron deficiency causes 50 percent of all anemia worldwide. Supplementing dietary iron with iron tablets, syrups, drops, or elixirs, and fortifying processed foods and condiments with iron are the best offense and defense against this cause of anemia. Where fortification has been evaluated in

specific populations, it has improved iron status and reduced anemia prevalence. In most developing countries, however, food industries are not well developed, and, where they are developed, most people cannot afford fortified foods. Supplementing dietary iron can meet the iron needs of vulnerable groups who do not consume fortified foods. Iron supplementation also has the advantage of meeting the needs of pregnant women and young children, whose high iron requirements cannot be met only with fortified foods. In countries where the feasibility of general dietary improvement is limited, iron supplementation for vulnerable groups and food fortification are the most cost-effective means of addressing iron-deficiency anemia.

Because anemia has many causes in addition to iron deficiency, many types of programs in the health sector and other social sectors have the potential to contribute to anemia prevention and control. An anemia component can and should be part of programs or activities in:

- Nutrition
- Infectious and parasitic diseases
- Antenatal care and safe motherhood
- Family planning and reproductive health
- Child health
- Schools
- HIV/AIDS prevention and treatment
- Food aid and security
- Environmental health
- Commercial sector: food and pharmaceutical manufacturers, marketers, and distributors

Sector-specific activities, when implemented concurrently as part of an anemia prevention and control strategy, can significantly reduce the prevalence of anemia and its debilitating consequences in targeted populations. In most cases, it is possible to add anemia prevention or control activities to already existing health or health-

related programs without large investments of time or resources.

Raising awareness of anemia prevention and control, promoting behavior change in the community, advocating for increased funding for national anemia programming, and training to build capacity among health workers are activities that can be implemented by any and all sectors and across sectors. They are most effective when approached in a coordinated, targeted manner.

Health professionals, governments, donors, nongovernmental organizations, the commercial sector, and civil society all have roles to play in achieving anemia prevention and control. Effectively implementing interventions requires an integrated approach of financial, technical, and political commitment and support. Partnerships and collaboration among these various players should be built at the national, provincial/state, district, and local levels from the outset of anemia programming. Input from and coordination among all potential parties is most critical in the key initial phase of planning an anemia strategy.

Knowing what has worked for others can facilitate the efforts of new programs to take action. **Part I: Program Guidance of Anemia Prevention and Control: What Works** thus presents good program practices for anemia prevention and control, with examples of good practices from around the world. **Part II: Tools and Resources** shares materials such as qualitative research instruments and methodologies, background data, norms and protocols, and references to also inform and support such efforts.

**COUNTRY EXAMPLE****ASSESSING THE EFFECTIVENESS OF ANEMIA PREVENTION AND CONTROL IN BOLIVIA**

In Bolivia, which has had a policy to give iron supplements to pregnant women since 1986, the 1997 Demographic and Health Survey (DHS) found that 27 percent of women of reproductive age were anemic. The survey data were not disaggregated between pregnant and nonpregnant women, but it is likely that anemia prevalence in pregnant women was higher. One study of antenatal care (ANC) clients, for example, found that 50 percent were anemic. Undoubtedly, anemia prevalence remains high because ANC coverage is low – only 50 percent of women have contact with health services during pregnancy. As a result, only 35 percent of pregnant women routinely receive iron-folic acid (IFA) supplements.

Anemia is also a problem in other population groups. In response to the 67 percent anemia prevalence the 1997 DHS found among children under age 3, the government has extended IFA supplementation to children under age 2. In addition, to help build the iron stores of the entire population, Bolivia now requires all wheat flour to be fortified with iron and other micronutrients.

In 2000, a qualitative assessment of Bolivia's public and private health systems (conducted as part of a larger World Bank study on nutrition) identified the strengths and constraints of IFA supplementation programs. Representative municipalities were chosen from the three geographic zones (highland plateau, valley, and plains) according to a human development index based on socioeconomic variables such as life expectancy at birth, educational level, and income, and on the presence of public and private health systems.

Observations of services and interviews with health staff, women, and mothers of young children showed that awareness of policies, norms, and protocols in support of IFA supplementation was low. The low priority given to iron and other micronutrients was reflected in such statements as "The Expanded Program on Immunization demands a lot of effort and causes lack of attention to the micronutrient component" and "During the technical council meetings, micronutrients have never been an important topic or item for discussion." The assessment also indicated a need to put micronutrients on the agenda of health care institutions.

In addition, most of the focus of IFA supplementation activities was on curative treatment of anemia rather than anemia prevention. Anemia control for young children was almost non-existent, despite the policy supporting IFA supplementation for children under 2. The IFA supplementation program for pregnant women was more active, but coverage was still lower than expected for a 15-year-old program. Reasons for this low coverage included:

- Copies of norms and protocols on anemia prevention and treatment not available in all health facilities
- Lack of standardization of norms and protocols
- Lack of training in how to use norms and protocols
- Failure to seek advice from knowledgeable, experienced personnel in the lower levels of the health system when developing norms and protocols
- Supply shortages preventing health workers and IFA users from complying with program norms

While supplies of IFA supplements were adequate at the national level, only 9 percent of the national supply was distributed between January and October 1999. As a result, only 21 percent of pregnant women received all of the recommended 90 supplements, and only 30 percent received 60. These findings are indicative of either (or both) an ineffective distribution and logistics system or a lack of demand for the supplements due to poor utilization of ANC services or poor supplement quality. In subtropical districts, problems with the quality of the IFA supplements were severe. One health worker noted that the supplements “turn to powder because of the humidity and women refuse to take them.”

Women rarely received consistent messages on when to take IFA supplements and how to manage side effects. Health worker training on anemia control and counseling was limited. In a few areas, some health staff received in-depth training on IFA supplementation through special programs such as the MotherCare and Opportunities in Micronutrient Interventions (OMNI) projects (funded by the U.S. Agency for International Development and implemented by John Snow, Inc.) and Integrated Management of Childhood Illness (IMCI) activities. In most cases, health workers felt they had forgotten most of what they had learned, indicating a lack of follow-up supervision to reinforce messages. The MotherCare/OMNI projects developed counseling cards and other behavior change materials for use throughout the country, but their dissemination and use stopped after the projects ended.

The World Bank study made the following recommendations to improve service quality:

- Ensure adequate supplies of IFA supplements for pregnant women and young children
- Make norms and protocols available to health workers who are giving supplements to pregnant women and children
- Train health workers to ensure that they 1) understand the importance of anemia, 2) follow norms and protocols, 3) improve their communication and interpersonal skills with women and mothers attending health services or receiving counseling, and 4) are able to convey effective messages to women
- Supervise health workers and programs adequately to ensure continuous quality improvement in services
- Scale up the success of smaller programs that have developed effective training and behavior change materials
- Utilize all channels in the health system (including community workers and public health programs such as immunization campaigns, growth-monitoring contacts, and pre- and postnatal care) to deliver iron to ensure that the most vulnerable groups receive supplies of IFA supplements or syrups

# Chapter I Anemia: "Lost Years of Healthy Life"<sup>1</sup>

## What Is Anemia<sup>2</sup> ?

*Anemia is defined as a low level of hemoglobin in the blood, as evidenced by a reduced quality or quantity of red blood cells.*

Hemoglobin is the substance in red blood cells that carries oxygen to the cells of the body. The body's cells need oxygen to function and enable a person to perform all physical and mental activities. When hemoglobin levels are low, as in a person who has anemia, less oxygen reaches the cells to support the body's activities. The heart and lungs also must work harder to compensate for the blood's low capacity to carry oxygen.

Internationally accepted hemoglobin values for defining anemia in different population groups are shown in **table 1.1**.

Age or Sex Group	Hemoglobin Value Defining Anemia (g/dL)
Children 6-59 mos.	< 11.0
Children 5-11 yrs.	< 11.5
Children 12-14 yrs.	< 12.0
Nonpregnant women > 15 yrs.	< 12.0
Pregnant women	< 11.0
Men > 15 yrs.	< 13.0

*Source: WHO/UNICEF/UNU (2001); values used in DHS.*

***Tools and Resources has an expanded version of table 1.1 with hemoglobin values for mild, moderate, and severe anemia, and hematocrit values for different age and sex groups.***

Anemia is subclassified into mild, moderate, and severe levels as hemoglobin values decline. It can also be measured in terms of the hematocrit content of packed blood cell volume.

## What Is the Impact of Anemia?

*Anemia makes it more difficult for men and women to earn incomes, carry out daily tasks, and care for their families. It makes women weaker during pregnancy and delivery, reducing their chances of having healthy babies and surviving blood loss during and after childbirth. Anemic infants and children grow more slowly than non-anemic infants and children. They are apathetic and anorexic, do not have enough energy to play, and have trouble learning. A 2002 World Health Organization report lists iron deficiency, a major cause of anemia, as one of the top 10 risk factors in developing countries for "lost years of healthy life."*

**Adult productivity.** In adults, one of the first signs of anemia is fatigue, which occurs when there is not enough oxygen in the body to support physical activity. Work productivity and earned income suffer accordingly. Preventing and treating all causes of anemia improves work output. A

In **Bangladesh, India, and Pakistan**, anemia-related losses in economic productivity amount to an estimated \$4.5 billion annually.

literature review from 1973 to 1981 found that a 10 percent increase in hemoglobin levels was associated with a 10 to 20 percent increase in work output. Adults with anemia are also less likely to engage in social activities and nurture and care for their infants and children.

**Maternal health.** Anemia reduces a woman's ability to survive bleeding during and after childbirth. Women with

<sup>1</sup> The 2002 *World Health Report* of the World Health Organization uses this concept to measure the impact of a number of health problems, including anemia.

<sup>2</sup> The terms "anemia" and "iron-deficiency anemia" are often used interchangeably. In this document, "anemia" means anemia from any cause, unless specified as "iron-deficiency anemia" – anemia caused only by iron deficiency.

severe anemia are particularly at risk and have a 3.5 times greater chance of dying from obstetric complications during or after pregnancy than women who do not have anemia. Anemia-related fatigue also makes the effort of labor more difficult, thus prolonging delivery.

Conservative estimates suggest anemia is the direct cause of 3 to 7 percent of maternal deaths worldwide. Other estimates suggest it is the direct or indirect cause of 20 to 40 percent of maternal deaths.

Although it is currently accepted that only severe anemia causes maternal mortality, it has been estimated that moderate anemia increases a woman's chance of dying 1.35 times, making it a risk for maternal mortality. Many more women have mild to moderate anemia than severe anemia. This underscores the importance of preventing and treating all forms of anemia, as the

***In Tools and Resources, "Shifting the Hemoglobin Distribution" shows the distribution of mild, moderate, and severe anemia in a population and describes its implications for program development.***

number of deaths associated with mild to moderate anemia is potentially greater than the

number associated with severe anemia. This is consistent with patterns seen with vitamin A and energy deficiencies, which, because of the greater numbers of people affected, also cause more deaths in their mild to moderate forms than in their severe forms.

**Young child development and learning.** Anemia is associated with premature births, intrauterine growth retardation, and low birthweight in infants. In turn, premature, underdeveloped, and underweight infants have decreased chances of survival. If they survive, they may have (both as infants and later as children) physical and mental developmental problems, including learning deficits, eating disorders such as anorexia, and poor growth. Full-term infants of anemic mothers have reduced iron stores and are at risk

of becoming iron-deficient and anemic during exclusive breastfeeding in the first six months of life. Iron-deficiency anemia, particularly in children under 2 years of age, can result in irreversible learning problems even if the iron deficiency and resulting anemia are corrected. In malaria-endemic areas, many children are anemic because of a combination of iron deficiency and untreated episodes of malaria. The hemoglobin levels of these children can drop to life-threatening levels. Iron deficiency also affects iodine uptake, increasing the risk of iodine deficiency disorders that can have devastating effects on fetal brain development and a child's IQ. Anemic children of all ages are apathetic, which affects social development.

**Adolescent development.** Because they are undergoing rapid growth, adolescents have high requirements for iron and are particularly vulnerable to anemia caused by multiple nutritional deficiencies and helminth infections. Both boys and girls are at risk, although prevalence peaks at different ages for each because the growth spurts of boys and girls occur at different ages.



Children and adolescents have high iron requirements because of rapid growth.

Iron requirements for boys decrease after they stop growing, while those for girls remain high throughout the reproductive years because of menstrual blood loss, the iron demands of the developing fetus, and blood loss during delivery.

### How Prevalent Is Anemia?

*There are more than 2 billion people in the world with anemia – one third of the world's population. Anemia prevalence is highest in developing countries. Worldwide, pregnant women and children, particularly children less than 2 years old, are the most vulnerable. In many countries, anemia prevalence is highest in rural areas.*

When national anemia prevalence surveys disaggregate anemia prevalence by age and sex, they generally show that the highest rates occur in pregnant women and young children under 2 years of age. National surveys may also include data for other groups, such as all reproductive-age

women, children under age 5, school-age children, adolescents,

**The table "Anemia Prevalence Rates in Vulnerable Populations, Selected Countries" appears in *Tools and Resources*.**

laborers with heavy workloads, farm laborers, and the elderly.

At the national level, anemia is considered a severe public health problem when anemia prevalence is equal to or greater than

40 percent. By the measures given in **figure 1.1**, anemia is a severe public health problem in nearly all developing countries. Anemia prevalence rates in industrialized countries are typically in the normal to mild range.

**Figure 1.1**

#### Public Health Significance of Anemia

Anemia Prevalence	Public Health Significance
≥ 40%	Severe
20-39%	Moderate
5-19%	Mild
0-4.9%	Normal

Source: WHO/UNICEF/UNU (2001).

**Tables 1.2** and **1.3** show estimates of anemia prevalence for developing and industrialized countries and different world regions. For all age groups, the risk of developing anemia is two to seven times greater in developing countries than in industrialized countries. Anemia prevalence is usually higher in rural areas than urban areas.

**Tools and Resources contains the table "Anemia Prevalence by Rural/Urban Residence, Selected Countries."**

Anemia prevalence is highest in WHO's South East Asia,<sup>3</sup> Eastern Mediterranean,

<sup>3</sup> WHO's South East Asia region includes South Asia.

**Table 1.2**

#### Prevalence of Anemia by Risk Group, Developing and Industrialized Countries, 1998\*

	0-4 yrs. (%)	5-14 yrs. (%)	Nonpregnant Women (%)	Pregnant Women (%)	Others (%)
<b>Developing Countries</b>	42**	53	43	55	Men: 35 Elderly: 51
<b>Industrialized Countries</b>	17	8	11	19	Men: 5 Elderly: 12

\* Estimates using hospital populations or data over 10 years old.

\*\* National data from countries within each region suggest that prevalence rates for children < 2 yrs. are higher than the rates shown here for children 0-4 yrs.

Source: SCN (2000).

**Table 1.3**

Anemia Prevalence, Children 0-5 Years and Pregnant Women, 1998

WHO Region	Children 0-5 yrs. (%)	Pregnant Women (%)
Africa	44	51
Americas	20	35
E. Mediterranean	48	55
Europe	25	25
South East Asia*	65	75
Western Pacific	24	43

\* includes South Asia  
 Source: SCN (2000).

and Africa regions, with the highest rates found among pregnant women and children. Increases in anemia prevalence occurred during the 1990s in Eastern Europe, the Caucasus, and Central Asian Republics. Prevalence is lower in Western Europe and in WHO's Western Pacific and Americas regions. Nonetheless, anemia prevalence among pregnant women and children in these areas persists at moderate to severe levels, according to internationally accepted standards. This reflects the difficulty of meeting the iron needs of these vulnerable groups even in areas where diets are relatively high in iron. Lower rates in some countries, however, indicate that targeted programs can address this problem.

In **India**, an estimated 131 million women of reproductive age (52 percent of this population) and 85 million children under age 4 (74 percent) are anemic. Combining these estimates with those for schoolchildren and adolescents, there are at least 360 million anemic individuals in India.

In **Cambodia**, 57.8 percent of reproductive-age women are anemic. This rate increases to 66 percent among pregnant women. Anemia prevalence is 63 percent among children under 5 but nearly 82 percent among 6- to 23-month-olds.

In **Egypt**, 29.7 percent of adolescents 11 to 19 years of age are anemic.

## What Are the Causes of Anemia?

*There are different causes of anemia worldwide. Their relative importance varies by region.*

In order of importance, the major causes of anemia are iron deficiency; other nutritional deficiencies; malaria; helminth infections (particularly hookworm but also schistosomiasis); chronic infections including HIV/AIDS and tuberculosis; causes related to reproduction and contraception; and genetic conditions such as thalassemia and sickle cell. These causes can be divided into direct causes and contributing causes. **Table 1.4** lists these direct and contributing causes and the components of each.

The relative importance of anemia's causes varies geographically. **Table 1.5** shows the importance of the major causes by region. In developing countries, there is seldom just one cause of anemia, while in industrialized countries anemia may be caused primarily by poor dietary intake of several nutrients.

### Direct Causes: Poor, Insufficient, or Abnormal Red Blood Cell Production

**Iron deficiency.** Iron deficiency causes 50 percent of anemia worldwide, making it the single largest cause of anemia. While iron deficiency causes anemia by reducing red blood cell production, iron deficiency itself may be exacerbated by excessive red blood cell loss (from menstruation, for example).

Iron is an essential component of hemoglobin, which is needed to make red blood cells. The body obtains iron from dietary iron, recycled red blood cells, or stored iron. Both quantity and quality of diet contribute to iron sufficiency. Substances in different foods have either inhibiting or enhancing effects on iron absorption. If there is not enough iron in the diet or if it is not well absorbed, the body cannot meet its requirement for iron, causing

**Tools and Resources contains the table "Substances That Inhibit and Enhance Absorption of Iron."**

Table 1.4 Causes of Anemia	
Direct Causes	Components (in order of importance)
Poor, insufficient, or abnormal red blood cell production	Poor dietary intake and/or absorption of iron Poor dietary intake and/or absorption of vitamins (A, B-12, folic acid, and possibly B-6, C, and riboflavin) and copper Increased needs for nutrients due to growth or disease (diarrhea) HIV/AIDS Other infectious diseases (tuberculosis, malaria) Genetic blood diseases (sickle cell disease or trait, thalassemia)
Excessive red blood cell destruction	Malaria
Excessive red blood cell loss	Helminth (worm) infections (hookworm, schistosomiasis) Bacterial or viral infections (peptic ulcers, gastritis, diarrhea) Reproduction (excessive blood loss during menstruation, delivery, and postpartum period; too many pregnancies; shortened postpartum amenorrhea) Contraceptive methods (intrauterine devices)
Contributing Causes	Components
Knowledge and behavior	Poor knowledge among health workers about anemia, iron supplementation, and other anemia prevention and control interventions Poor knowledge among vulnerable groups about the importance of anemia and anemia prevention and control interventions Cultural taboos or biases (e.g., women eating after others) Practices that restrict food intake, including poor infant breastfeeding practices and inadequate introduction of complementary foods Poor compliance with recommended behaviors (iron supplementation; malaria, tuberculosis, and other medication regimens; use of family planning; use of sanitation facilities; HIV prevention behaviors)
Environmental	Contamination by heavy metals (lead)
Lack of access to services	Low use of antenatal and other services providing iron supplements Lack of trained birth attendants to manage bleeding during delivery Lack of access to sanitation services that mitigate helminth infestation Lack of access to bednets to prevent malaria transmission
Poverty	Lack of income to buy foods with adequate amounts of absorbable iron or to obtain iron supplements, malaria treatment, insecticide-treated bednets, shoes to prevent helminth infection, and other preventive commodities or services
<i>Source:</i> Adapted from Gillespie and Johnston (1998).	

a decline in red blood cell production and hemoglobin levels. If dietary iron is not increased or some other source of iron (such as supplements) is not available, anemia occurs.

Red blood cell production increases as the iron requirements of individuals increase. Iron requirements are high during periods of rapid growth, which occur in the fetus, children less than 2 years old, preschool and school-age children, and adolescents. Individuals who experience excessive blood loss also have high iron require-

ments. Pregnant women are particularly susceptible to anemia, as the growth of the fetus and other physiological changes during pregnancy increase the need for iron.

In both industrial and developing countries, stan-

dard diets do not provide the amount of iron needed during pregnancy, so iron supplementation is necessary. Healthy

***In Tools and Resources, the table "Demands for Iron in Pregnancy" outlines the iron losses and gains in pregnant women.***

	<b>Iron Deficiency</b>	<b>Malaria</b>	<b>Sickle Cell</b>	<b>Thalassemia</b>	<b>HIV/AIDS</b>	<b>Hookworm</b>	<b>High Fertility</b>
<b>Sub-Saharan Africa</b>	+++	+++	++	+	++	++	+++
<b>North Africa</b>	+++	+	+	++	+	+	++
<b>Americas</b>	+++	+	+	+	+	+	+
<b>Central Asia/Caucasus</b>	+++	++	++	++	+	+	++
<b>Eastern Mediterranean</b>	+++	++	++	++	+	+	++
<b>Europe (Industrial)</b>	+	—	+	+	+	—	—
<b>South East Asia*</b>	+++	++	+	+	+	+	++
<b>Western Pacific**</b>	+++	+	+	+	+	++	+

\* includes South Asia    \*\*includes China

**Key:** +++ very important as a cause; ++ of medium importance; + of mild importance or important on a regional basis; --- not significant or not of public health significance

*Source:* Warren et al. (1993); Fairbanks (1999); various DHS.

infants of healthy mothers receive sufficient iron from their stored iron as well as a small but absorbable amount of iron from breast milk. Complementary foods to supply iron need to be introduced at six months, when iron stores are exhausted. Children between 6 and 24 months of age need iron supplements because most standard diets do not supply enough iron (see box **The Special Iron Needs of Children Under Age 2**).

Not all individuals with iron deficiency develop anemia and not all people with anemia are iron-deficient, as demonstrated in **figure 1.2**. Anemia is the most serious manifestation of iron deficiency, and in places where iron deficiency is the main cause of anemia, many more people are iron-deficient than anemic. In areas where more people have anemia due to other causes, iron deficiency may still be a significant cause of anemia.

**Deficiencies in other nutrients.** Anemia is also caused by poor dietary intake and

poor absorption of other key nutrients needed for red blood cell production. In conjunction with iron deficiency, deficiencies of folic acid and vitamins A and B-12 cause nutritional anemia. Deficiencies of vitamins B-6 and C, riboflavin, and copper are also associated with anemia, but there is little evidence that these deficiencies contribute significantly to anemia in developing countries. Deficiencies in other nutrients can cause other devastating problems. For example, if a woman is deficient in folic acid around the time of conception, the deficiency can cause neural tube and other developmental defects in the fetus.

Undernutrition itself can cause poor red blood cell production (as well as retarded growth, immunodeficiencies, and learning deficits independent of iron-deficiency anemia), and addressing undernutrition in vulnerable groups is essential to correcting anemia in a sustainable way. The quantity of micronutrients consumed, particularly iron, depends both on the type and amount of food consumed. Knowledge of

## The Special Iron Needs of Children Under Age 2

Until 6 months of age, normal-weight, full-term infants who are born to healthy mothers and are exclusively breastfed receive enough iron from their own stored iron and from breast milk. Their stored iron is exhausted in about six months. Additional iron is then required because the iron content of unfortified conventional complementary foods is insufficient to meet the high iron requirements of growing 6- to 24-month-old infants and children. Infants and children who do not obtain adequate iron will suffer cognitive impairment that will affect their ability to learn and to perform income-earning tasks later in life. Iron supplements provided after 24 months of age may not correct this cognitive impairment.

Low-birthweight infants, premature infants, and infants of mothers with anemia need additional iron starting at about 2 months of age to build iron stores and meet the requirements of their rapid growth. Non-exclusively breastfed infants also may need small amounts of additional iron to compensate for the iron they do not receive through breast milk. The iron requirements of children with severe malnutrition and anemia need special attention.

National iron-deficiency anemia programs for young children exist only in a few countries, but new products for supplementing or fortifying diets may lead to promising interventions in more areas. Products under study and development include multimicronutrient sprinkles, spreads, and other forms of micronutrients to add to food. Work on these and other products needs to increase and accelerate to facilitate new and expanded programs in countries where iron deficiency is still a major cause of anemia in children less than 2 years old.

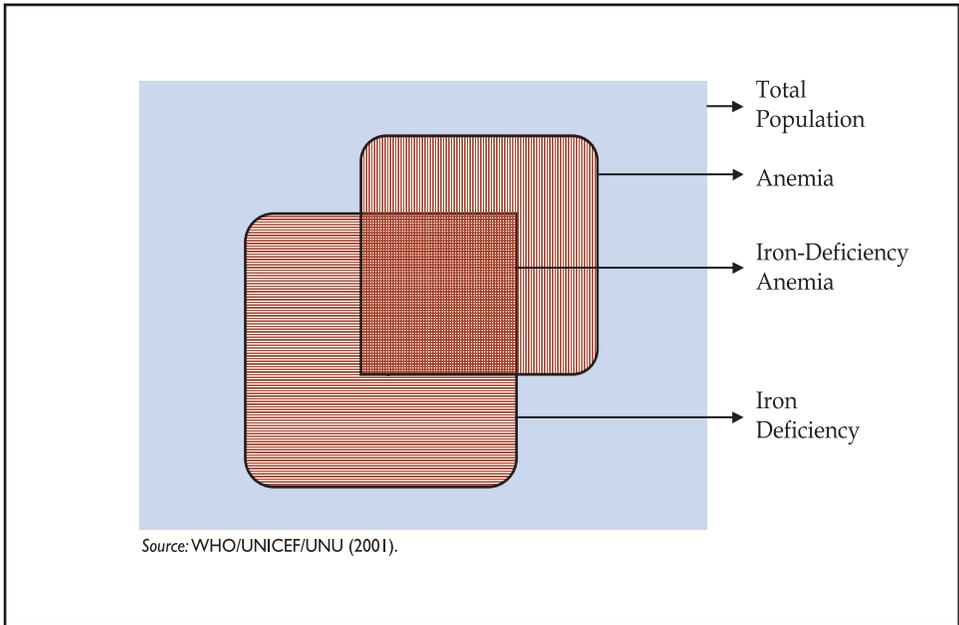
the kinds and amounts of food that should be eaten may be inadequate and thus affect micronutrient consumption. Inequities in food distribution within families and chronic or recurrent health conditions may also prevent the food and micronutrient needs of vulnerable groups from being met.

**HIV/AIDS.** People who have HIV infection and are anemic are at greater risk of dying than those without anemia. Their risk of dying increases as their hemoglobin decreases, and they have high requirements for iron and other micronutrients. Their risks of anemia may increase because of poor diet and inadequate nutritional care affecting their red blood cell production. People living with HIV/AIDS are often anorexic and may have mouth sores that cause eating problems, resulting in reduced food intake. Iron deficiency and the presence of other infections can further reduce appetite and exacerbate anemia. HIV infection itself suppresses red blood cell production. When HIV infection develops into AIDS, anemia may become severe as iron is sequestered in the liver and muscle. Certain types of AIDS treatments reduce this iron build-up and alter the body's iron balance. If iron deficiency

already exists, further negative effects on immune function may result.

**Other infectious diseases.** Other infectious diseases make anemia more severe by increasing metabolism, thus increasing iron and other micronutrient requirements. Measles, for example, can increase the risk of vitamin A deficiency, which in turn can increase the risk of anemia. There is an association between malnutrition, anemia, and tuberculosis. Chronic diarrheal disease in children causes malabsorption and undernutrition, affecting red blood cell production. Some of the anemia in chronic diseases is due to inflammation or swelling of tissues and not related to poor nutritional status.

**Genetic conditions.** Genetically linked blood diseases and hemoglobin abnormalities such as sickle cell and thalassemia cause abnormal hemoglobin production. People with sickle cell disease or sickle cell trait have genetically altered hemoglobin that offers some protection against malaria but increases risks of anemia. About 1 to 2 percent of infants in Africa are born with sickle cell disease and are at high risk of severe anemia and death. People with



**Figure 1.2. Relationship Between Iron Deficiency, Iron-Deficiency Anemia, and Anemia in a Population.** More people are affected by iron deficiency than have iron-deficiency anemia. While anemia can be caused by factors other than iron deficiency, most people with anemia in developing countries are also iron-deficient.

sickle cell trait (which occurs in 30 percent of Africa’s population) do not have severe anemia but have a slight reduction in functional hemoglobin. Thalassemia (both alpha and beta) is concentrated in Africa, Asia, the Middle East, and the Mediterranean region. It can be life-threatening in children but does not represent a significant public health problem worldwide. Identifying individuals with thalassemia is probably not cost-effective in most developing countries because the number of people affected is relatively small and tests are expensive.

**Direct Causes: Excessive Red Blood Cell Destruction**

**Malaria.** Malaria parasites destroy red blood cells and suppress red blood cell production. All persons living in or visiting areas with endemic malaria transmission are at risk of anemia from malaria. In areas of intense malaria transmission, malaria infection – usually accompanied

by iron deficiency – causes life-threatening severe anemia in children under 2 years of age and in women in their first and second pregnancies.

In *Nepal*, anemia prevalence in women has been associated with intensity of malaria and hookworm infections.

**Direct Causes: Excessive Red Blood Cell Loss**

**Helminth (worm) infections.** In developing countries, excessive red blood cell loss and resulting iron-deficiency anemia are caused by worm or helminth infections. Two types of hookworm, three types of schistosomes, and whipworm all cause blood loss. Among these infections, hookworms are the most common cause of anemia and schistosomes the second most common. Hookworms are contracted when parasites enter the skin, generally through the feet as people walk barefoot on feces-contaminated soil. They consume

the blood of their host and cause significant blood loss. Endemic hookworms are a significant cause of anemia in children after the ages of 2 or 3 years.

**Bacterial and viral infections.** Infections that cause peptic ulcers and gastritis (specifically *Helicobacter pylori*) are common in developing countries. They cause anemia by increasing blood loss but also by reducing stomach acid, resulting in poor absorption of iron. Diarrhea caused by particular bacterial infections may also cause anemia, especially if the diarrhea is chronic and characterized by bloody stools.

**Reproduction and contraception: menstruation, childbirth, breastfeeding practices, contraceptive practices.** Women who have excessive blood loss during menstruation and childbirth have increased risks of developing anemia.

*The table “Anemia Prevalence Rates in Vulnerable Populations, Selected Countries” in Tools and Resources shows anemia rates among pregnant women, intrauterine device users, and other women of reproductive age.*

in which a number of nutritional deficiencies lead to anemia. Introducing food and water in an infant’s diet before the infant has completed six months of exclusive breastfeeding may increase the mother’s anemia risk because the period of lactational amenorrhea (which reduces menstrual blood loss) is shortened. Intrauterine devices can increase blood loss, as opposed to oral and injectable contraceptives (such as Depo-Provera), which reduce menstrual blood loss.

Demographic and Health Surveys in *Armenia, Egypt, Kazakhstan, Kyrgyz Republic, Turkmenistan, and Uzbekistan* have reported anemia rates among intrauterine device (IUD) users 1.6 to 14.5 percentage points higher than rates among women not using IUDs.

Also, having many closely spaced pregnancies can cause “maternal depletion” syndrome,

## Contributing Causes

**Poor knowledge and behaviors.** Lack of knowledge contributes to high anemia prevalence worldwide. Poorly trained health workers may not know or believe anemia is important and thus may fail to promote preventive behaviors. People at risk of anemia may not know it is an important contributor to poor health and may not be aware of preventive behaviors such as good nutrition and dietary practices, good infant feeding practices, sanitation-related practices, and sleeping under bednets for malaria protection. Cultural biases and taboos (such as those prohibiting certain foods or requiring women to eat after others have finished) also contribute to anemia risk, as does noncompliance with modern family planning methods, IFA supplements, and malaria or hookworm medications.

**Environmental causes.** Anemia caused by lead poisoning, which interferes with hemoglobin production, is a problem in crowded urban areas where lead paint is still used or where automobiles still use leaded gasoline. Lead competes with iron during absorption, so poor dietary intake of iron exacerbates lead poisoning by allowing more lead absorption than would occur in an iron-replete individual.

**Lack of access to health services and poor sanitation.** Poor access to health services and poor sanitation conditions and practices also contribute to higher anemia rates. Antenatal care services are an appropriate venue for delivering anemia interventions. However, access to these services is low in many countries, with many women having few visits or

*Tools and Resources contains the table “Proportion of Women Utilizing Antenatal Care (ANC) Services and Receiving/Taking Iron or Iron-Folic Acid (IFA) Supplements, Selected Countries.”*

beginning them late in pregnancy. Additionally, in many countries, women do not have trained attendants during delivery to manage severe bleeding if it

occurs. In many areas, lack of sanitation or poor sanitary practices, such as walking without shoes through feces-contaminated soil, contribute to anemia by increasing the risk of helminth infection.

**Poverty.** The poor are at greater risk of anemia due to lack of income and other resources that prevents them from consuming a diet with adequate, well-absorbed iron. Iron is a highly income-elastic micronutrient. As family incomes rise, families tend to purchase more meat, which contains a type of iron that is better absorbed than the iron in most plant products.

In addition, lack of income may prevent the poor from utilizing health services. Anemia risks are increased by the inability to pay for maternal and child health services, iron supplements, malaria and deworming medications, bednets, and other protective interventions.

In *Andra Pradesh, India*, anemia rates are highest among the lowest income group. Although iron supplementation is high, 14 percent of the poor do not receive iron in pregnancy, compared to 8 percent in the highest income group. This contributes to higher anemia prevalence among the poor.

## Chapter II

# Taking Action: Developing a Strategy for Anemia Prevention and Control

Most anemia prevention and control programs have focused only on reducing the anemia caused by iron and folic acid deficiencies. However, because anemia has a number of different causes (see **Chapter I, Anemia: “Lost Years of Healthy Life”**), it is best addressed by adding anemia prevention and control activities to existing programs in public health and other sectors, and, where needed, by introducing new programs.

This chapter recommends that to initiate anemia prevention and control, a strategy or long-term plan should be developed. This strategy or plan should cover:

- Surveying the anemia problem
- Assessing related programs
- Suggesting improvements to current programs or introducing new programs
- Designing monitoring and evaluation activities

As part of the planning process, partners should be identified and brought in to assist in strategy development. However the process begins – in the efforts of one individual, as an initiative of private citizens, or as a new public sector activity – it should become a collaborative venture involving all potential stakeholders, including governments and government agencies, donors, civil society, nongovernmental organizations, health professionals, and the commercial sector. Building these partnerships is critical in the initial planning phase.

Existing data about which population groups are anemic, where these groups are concentrated geographically, and the specific causes of anemia provide the basis



A child in Cambodia receives vitamin A, iron supplements, and de-worming medication.

for developing an anemia prevention and control strategy. In most cases, it is possible to add anemia prevention or control activities to already existing health or health-related programs without large investments of time or resources. Potential program partners in anemia prevention and control include the following health and health-related sectors:

- Nutrition
- Infectious and parasitic diseases
- Antenatal care and safe motherhood
- Family planning and reproductive health
- Child health
- Schools
- HIV/AIDS prevention and treatment
- Food aid and security
- Environmental health
- Commercial sector: food and pharmaceutical manufacturers, marketers, and distributors

Specific activities to prevent and control iron deficiency, which is a major cause of

anemia, should be part of the strategy.

**Chapter III, Providing Iron Supplements to Combat Anemia**, and **Chapter IV, Improving Dietary Iron Intake to Combat Anemia**, provide guidance for supplementing dietary iron and increasing the amount of iron in the diet through food fortification, the major interventions for addressing iron-deficiency anemia.

The anemia prevention and control strategy should include indicators for monitoring and evaluating anemia prevention and control activities. These indicators and a plan for collecting relevant data should be developed in the strategy planning stage.

Effectively implementing interventions of any kind requires an integrated approach with financial, political, and technical commitment and support. The key to the immediate success and long-term sustainability of an anemia prevention and control strategy is the support of government at all levels – national, provincial/state, and local – and, where needed, international organizations.

The **Country Example** that follows describes how Indonesia worked to improve its anemia prevention and control program by targeting antenatal care clients and by introducing an integrated approach of activities across a number of sectors and programs.

The **Good Practices Checklist** shows the steps for developing an anemia prevention and control strategy. The steps are presented in a suggested order of implementation. The **Good Practices in Detail** section describes specific actions that managers, concerned policy makers, and others should take in following these steps to develop a strategy. It emphasizes the importance of taking an integrated approach to anemia programming and of building partnerships at all levels to accomplish anemia prevention and control objectives. It also suggests “sector-specific interventions” that can be added to health and other programs to help prevent and control anemia.

**Part II** of this document, **Tools and Resources**, provides research instruments and methodologies, background data, norms and protocols, and references that provide additional information to help program and project managers design, implement, and monitor interventions.

## COUNTRY EXAMPLE

# EXPANDING ANEMIA PREVENTION AND CONTROL IN INDONESIA

Anemia prevalence is high in a number of groups throughout Indonesia. After initiating efforts to reduce anemia in pregnant women in 1985, Indonesia has since expanded its anemia prevention and control strategies and is addressing anemia prevalence in other vulnerable groups through a number of measures.

As the table below indicates, the 1995 National Household Survey (NHHS) found prevalence highest among adolescent girls, followed by pregnant women, school-age children, children less than 5 years old, and all women of reproductive age.

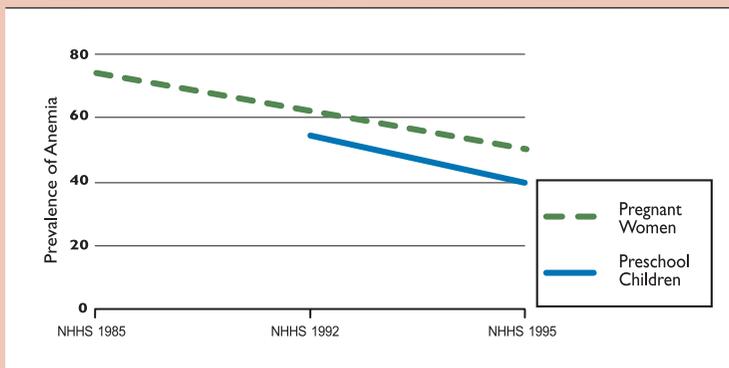
**Anemia Prevalence in Vulnerable Populations in Indonesia**

Vulnerable Group	% Anemic
Pregnant women	50.9
All women of reproductive age (15-44 yrs.)	39.5
Young children (0-5)	40.5
School-age children (5-11)	47.2
Adolescent girls (10-14)	57.3

Source: 1995 NHHS.

National survey data show that anemia prevalence in pregnant women decreased from 73.7 percent in 1985 to 50.9 percent in 1995, a 31 percent decline. This suggests that progress had indeed occurred by the mid-1990s. As seen in the figure below, anemia prevalence in preschool children (0 to 5 years of age) also decreased from 55.5 to 40.5 percent between 1992 and 1995.

**Prevalence of Anemia (%) in Pregnant Women and Preschool Children, 1985-1995**



The change in anemia prevalence in pregnant women accompanied increased attention to anemia prevention and control in antenatal care (ANC) services. Several good practices were identified as responsible for the improvements in this program:

- High commitment from the Indonesian government to control anemia
- Monitoring systems for anemia and iron-folic acid (IFA) supplement use
- Improved packaging to protect IFA supplements from humidity and make them more attractive to consumers
- A change to a red, film-coated supplement that did not have the fishy taste of the previous supplements
- Messages about when and how to take IFA supplements to mitigate side effects
- Increased supply and availability of IFA supplements at each level of the health system, including distribution by community health workers (village midwives and traditional birth attendants) and private sector sales by drug vendors and small shops
- Availability of program guidelines and protocols on how many IFA supplements to give

These improvements have increased the number of pregnant women receiving and taking IFA supplements. Demographic Health Surveys in 1994 and 1997 indicated a 36 percent decline in pregnant women receiving no IFA supplements (from 26.4 to 16.9 percent) and a 69 percent increase in pregnant women receiving 90 or more IFA supplements (from 14.4 to 24.4 percent). There were not commensurate increases in the number of women receiving ANC from a trained provider or in the number of women receiving four or more ANC visits. The increase in coverage for IFA supplements thus was not due to an increase in ANC use but to specific actions taken to improve IFA supplement distribution.

Indonesia has also developed protocols for giving iron supplements to children ages 6 to 60 months, but these recommendations have not been extensively implemented. Nonetheless, anemia prevalence also declined for this group between 1992 and 1995. This decline may have been due to improvements in overall nutritional status or in maternal iron status, resulting in better iron stores in newborn infants.

In addition, the Directorate of Nutrition in Indonesia's Ministry of Health has collaborated with a number of other ministries to address anemia and introduce IFA supplementation to various population groups. Collaborating ministries include the Ministry of Religious Affairs to work with engaged or newly married women and children attending Islamic schools; the Ministry of Education to reach other school-age children; the Ministry of Manpower to introduce IFA in workplaces; and the Ministry of Industry and Trade to introduce iron-fortified flour. The Government has worked with parastatal and private sector pharmaceutical companies to sell IFA supplements in retail shops throughout the country. While the commitment of these various sectors needs strengthening, as do behavior change communications, Indonesia has made important steps in improving anemia prevention and control provided by ANC services and in expanding activities beyond those targeted at pregnant women.

# Taking Action: Developing a Strategy for Anemia Prevention and Control

## Good Practices Checklist

*(Note: These steps are presented in a suggested order of implementation.)*

### KNOW THE PROBLEM: SITUATION ANALYSIS

- Determine anemia prevalence; identify priority target groups, areas of greatest anemia prevalence, and anemia causes
- Determine what people know about anemia and their experience with anemia prevention and control programs

### RAISE AWARENESS AND DEVELOP PARTNERSHIPS

- Raise awareness across sectors: advocate and educate to prevent and control anemia
- Build partnerships in the health, agriculture, food, and pharmaceutical sectors among government ministries and agencies, nongovernmental organizations (NGOs), donors, industry, and commerce

### DEVELOP INTERVENTIONS AND IMPLEMENTATION PLANS

- Identify priorities, responsibilities, and timeframes
- Identify specific objectives
- Identify potential collaborating groups (universities, government agencies, NGOs, civic groups, commercial entities)
- Review existing programs and determine and develop anemia prevention and control activities
- Determine and secure staffing, funding, and other resources for implementing activities
- Develop a monitoring and evaluation plan

### SECTOR-SPECIFIC INTERVENTIONS TO PREVENT AND CONTROL ANEMIA

The following health and related sectors can implement anemia prevention and control interventions:

- Nutrition
- Infectious and parasitic diseases
- Antenatal care and safe motherhood
- Family planning and reproductive health
- Child health
- Schools
- HIV/AIDS prevention and treatment
- Food aid and security
- Environmental health
- Commercial sector: food and pharmaceutical manufacturers, marketers, and distributors



# Taking Action: Developing a Strategy for Anemia Prevention and Control

## Good Practices in Detail

### Know the Problem: Situation Analysis

- Determine anemia prevalence; identify priority target groups, areas of greatest anemia prevalence, and anemia causes

National anemia surveys provide convincing evidence of the need for anemia prevention and control and help program developers and project managers advocate for programs.

*Tools and Resources contains the table “Anemia Prevalence Rates in Vulnerable Populations, Selected Countries.”*

In the last five years, national anemia surveys from all

parts of the developing world have confirmed the findings of smaller surveys that anemia rates are high in reproductive-age women and children under 2 years of age in all regions. National studies are needed for all developing countries. If resources are available, data on anemia in preschool and school-age children, adolescents, heavy laborers, farm workers, and the elderly should also be collected. Baseline surveys on existing interventions may be necessary to collect quantitative information on, for example, the number of people in vulnerable groups receiving and correctly using iron or iron-folic acid (IFA) supplements, anthelmintics, and antimalaria drugs; the number of people sleeping under insecticide-treated bednets; the number of women using intrauterine devices (IUDs) and oral contraceptives (with and without iron); the number of health workers and workers in other fields trained in anemia control; and national supply and distribution figures for supple-

ments and other commodities. If national or other broad surveys are too expensive or not

feasible for other reasons, anemia prevalence can be estimated using hemoglobin values collected from smaller populations during other health surveys.

**Figure 2.1** shows groups affected by anemia and the suggested priority for addressing them. Pregnant women and children under age 2 are the highest priority groups because they have the highest requirements for iron and are most vulnerable to parasitic infections. Lactating women are

*Tools and Resources contains “Selected Monitoring and Evaluation Indicators for Anemia Prevention and Control Programs,” which lists indicators that can help formulate survey questions.*

**Figure 2.1**



of higher priority than other women of reproductive age because of blood loss at delivery and during the postpartum period. Newly or soon-to-be married women are of high priority because many are adolescents who are still growing. Most of these women will become pregnant soon after marriage, and many will have anemia when they become pregnant.

The 1998/99 Family Health Survey in **India** collected data on both anemia prevalence and iron supplementation coverage.

**Bangladesh** targeted newly married women, providing them with iron tablets and counseling to improve their iron status.

In **Peru**, adolescent girls are a priority group. They receive iron and are targeted for improving dietary iron through schools and communities.

In **India**, pregnant women are a primary target group for anemia prevention and control. Children ages 1 to 5 years, IUD users, adolescent girls, women in post-abortion care, and preterm/low-birthweight infants are also targeted.

**Thailand** targeted anemia prevention and control activities to factory workers, schoolchildren, and adolescents.

Anemia prevention and control programs should address anemia where it is geographically concentrated. Prevalence surveys can help disaggregate anemia prevalence by province, district, rural and urban settings, and altitude. Disaggregation of data from national to lower levels requires greater sample sizes, however, and will be more costly.

In most countries, the major causes of anemia are known. They include iron deficiency; other nutritional deficiencies; malaria; helminth infections (particularly hookworm but also schistosomiasis); chronic infections, including HIV/AIDS; causes related to fertility, reproduction, and contraception; and genetic conditions such as thalassemia and sickle cell. The relative importance of the different causes of anemia varies by world region (see **table 1.5** in **Chapter I, Anemia: “Lost Years of Healthy Life”**); it may also vary by regions within countries. Iron deficiency is always a contributing cause of anemia in developing countries. In most areas of Africa, other nutritional deficiencies, malaria, and hookworm are regionally significant. These causes are usually known from evidence of worm infestation or knowledge of dietary intake in the general population or vulnerable groups. Reviews of health-related programs can supplement information about anemia’s causes in particular areas or set-

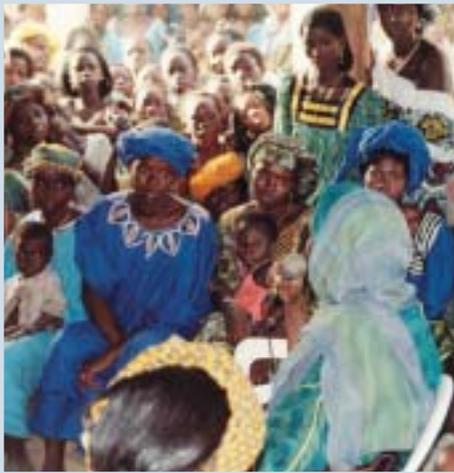
tings. Studies to determine the relative importance of iron deficiency and other causes of anemia are expensive, however, and should be limited to population subsamples. In some individual cases, clinical assessment may be necessary to confirm a specific cause of anemia.

An analysis of a population group’s dietary intake can help ascertain the extent or importance of iron deficiency or other nutritional causes of anemia in the group. Dietary intake often varies widely by geography and season, an important factor in determining prevalence.

It may also be important to analyze intake of other micronutrients and determine if there are serious deficiencies that warrant their addition to foods or supplements. Other micronutrients associated with anemia and other health problems include folic acid, riboflavin, vitamins A and B-12, thiamin, and zinc. Adding these to iron supplements and fortified foods should be considered, especially if inexpensive micronutrient mixtures containing them are available. Folic acid is particularly important for preventing neural tube defects, which are prevalent in developing countries with 370,000 cases reported globally every year.

#### **□ Determine what people know about anemia and their experience with anemia prevention and control programs**

Formative research – both qualitative and quantitative – is an important step in developing an anemia strategy. It can clarify what people know about anemia and what behaviors they are able and willing to change to prevent and control it. It can help determine how consumers, health workers, policymakers, and program and project managers perceive anemia. Formative research can also help evaluate existing programs and aid in the development of products such as iron tablets, other forms of iron supplements, and fortified foods. Research findings can help identify appropriate interventions with



Qualitative research includes asking consumers about their health-related beliefs and practices.

appropriate monitoring and evaluation indicators. They can also suggest themes and messages for advocacy, counseling, and social marketing, as well as ways to improve training, education, and products. For example, qualitative research helped establish that women taking iron supplements preferred small sugar-coated red tablets over large fishy- or chalky-tasting brown ones. A single study can determine overall perceptions of anemia as well as attitudes about iron tablets, antimalaria and anthelmintic drugs, bednets, and fortified foods. Qualitative research can also test products such as iron tablets and fortified foods once they have been developed.

The first step is to develop a research instrument that is primarily qualitative in nature. Communication specialists and

marketing experts have the skills and experience to gather the qualitative data needed for informed

planning. Nutritionists should be involved in qualitative data collection to ensure that the right nutrition questions are being asked.

Formative research should also review:

- Programs that are already having a positive impact on anemia
- The potential of these programs to have a greater impact
- The potential impact of programs not yet involved in anemia

These include programs in nutrition, infectious and parasitic diseases, antenatal care and safe motherhood, family planning and reproductive health, child health, schools, HIV/AIDS prevention and treatment, environmental health, and food aid, as well as activities in the commercial food and pharmaceutical sectors. Findings about the potential roles and contributions of these programs should be presented to and discussed with program and project managers, policymakers, donors, consumer groups, and commercial representatives to obtain their input and find common grounds and goals for program activities.

*Tools and Resources contains “A Tool for Reviewing Micronutrient Programs” and “Qualitative Research Instrument on Perceptions of Anemia and Use of Iron Supplements – The Indramayu Project, Indonesia.”*

### Some Qualitative Research Findings About Anemia

Qualitative research among women in several countries suggests that they often recognize the signs of anemia but do not know or understand its consequences. In most cases, women are not aware of medical terms such as “anemia” but have local terms like “lack of blood” for anemia’s signs of pallor and fatigue. Where women are familiar with iron-folic acid (IFA) supplements, they report that they like taking them, at least initially, and side effects are not a problem. They have concerns, however, about taking supplements for a long time – they fear, for example, that long-term use causes women to have large babies. They seldom receive counseling to counter such misperceptions and encourage continued use of supplements. Research also shows that because prevention is not a well-understood concept in most countries, women might stop taking IFA supplements once they feel stronger. (See *Chapter III, Providing Iron Supplements to Combat Anemia.*)

## Raise Awareness and Develop Partnerships

### □ Raise awareness across sectors: advocate and educate to prevent and control anemia

In many cases, program managers, health professionals, policymakers, the public at large, and groups vulnerable to anemia are not aware that anemia is a significant problem. There are many interventions that can be implemented by any and all programs in the health sector and other social sectors to raise awareness in these groups. These include interventions designed to encourage behavior or policy changes and introduce and sustain program improvements. Advocacy may be targeted at policymakers and the public (or both) to raise their awareness of anemia; at health professionals to encourage them to take action against anemia; and at the public to promote behavior change. Information, education, and communication (IEC) activities, such as training in counseling and capacity building for communication, may also be targeted to these groups to improve existing programs.

To accomplish these cross-sector objectives, programs can:

- Recruit a well-known person with high name recognition as an anemia “champion” or spokesperson who will advocate for anemia prevention and control in different sectors and raise political and public support for anemia prevention and control programs
- Take advantage of national health campaigns such as “national immunization days” and “micronutrient days” to raise awareness about anemia
- Engage the media – radio, newspapers, television – to disseminate anemia prevention and control messages
- Develop and use fact sheets (which can be tailored for use in different sectors)

In **Indonesia**, community meetings were held with men and community leaders to talk about anemia and distribute leaflets on the importance of women taking iron supplements. Respected religious leaders promoted the value of iron tablets and enlisted family support. Reaching out to communities through the media was also effective. Donor assistance supported nutritionist training.

In **Chile**, a national anemia champion promoted anemia prevention and control. Also, scientists were trained in anemia prevention and control both in Chile and the United States to increase technical capacity, especially at the implementation level.

In **China**, the government translated international documents on the consequences of anemia to build support for anemia control.

In **Egypt**, the government publicized scientific research about the safety of dietary iron to combat public perceptions that it was dangerous.

In **Thailand**, a public relations campaign emphasized private sector contributions to social sector programs.

In **Mali, Mozambique, and Indonesia**, supplements have been distributed on national micronutrient days and through community-based outlets.

In **Niger**, IFA supplements have been distributed on national immunization days.

In **Malawi**, health worker training emphasized the role of iron supplements in combating anemia in pregnant women.

In **India**, improvements were made in in-service training on anemia prevention and control for health workers.

In **Peru**, teachers were trained in anemia prevention and control.

to educate target groups about anemia’s prevalence, its causes and effects, and prevention and control interventions

- Secure the support of respected religious leaders and involve them in advocacy activities

- Convince government officials and representatives from the commercial food and pharmaceutical sectors of the importance of anemia prevention and control

***Tools and Resources contains the sample fact sheets “How Can Early Childhood Development (ECD) Programs Beat Iron Deficiency?”, “The Impact of Preventing and Treating Iron Deficiency Anemia”, and “Risk of Iron Overload From Iron-Fortified Foods.”***

- Build capacity and provide training for health workers in technical knowledge, communication for behavior change, counseling skills, program design and implementation, program management (including supervision), and monitoring and evaluation
  - Provide pre- and in-service training for personnel from food, sanitation, education, and other sectors to incorporate anemia prevention and control in their activities
- Build partnerships in the health, agriculture, food, and pharmaceutical sectors among government ministries and agencies, nongovernmental organizations (NGOs), donors, industry, and commerce**

Addressing anemia through and across a number of sectors requires close cooperation and coordination among government agencies, NGOs, donors, and commercial sector entities. A national intersectoral committee can help achieve and coordinate an integrated approach with counterparts at the regional, provincial/state, district, and community levels. Participating sectors and groups should include ministries of health, education, women’s affairs, youth, trade, industry, agriculture, and planning; donor agencies; the food and pharmaceutical industries; consumers; and technical experts in science, research, and marketing. Such a committee should have its own budget and staff. Committee members should agree there is an anemia problem and agree upon a common goal to which each organization can contribute.

In **Chile**, politically adept nutrition planners were able to bring government, industry, and the research community together on a national committee to work for anemia prevention and control. The committee raised community and consumer support for nutrition and anemia prevention and control programs.

In **Thailand**, medical professionals convinced commercial sector partners about the importance of iron fortification and supplementation.

In **Tanzania**, a favorable sociopolitical environment and the government’s commitment to social action with community involvement contributed to a successful national strategy to improve nutrition programming. Specialists from the national nutrition coordinating body, the Tanzania Food and Nutrition Centre, helped the government with anemia programming.

## Develop Interventions and Implementation Plans

### □ Identify priorities, responsibilities, and time frames

Working toward their common goal, the partners need to decide what anemia prevention and control activities are important, who is responsible for them, and when they will be carried out. These decisions should be based on the nature of the national anemia problem and a review of existing programs. When making these decisions, the partners should clearly articulate priorities and goals, delegate responsibilities to appropriate sectors, and establish time frames for initiating actions.

### □ Identify specific objectives

Specific objectives or results may include increased awareness of anemia as a public health problem, improvement of existing anemia programs, introduction of new programs to prevent and control anemia, and reduction of anemia prevalence. Objectives should be time-bound and measurable to allow for monitoring and evaluation.

In **Thailand**, political commitment, good strategic planning, and motivational programming in communities and the health care system were instrumental in implementing a basic “minimum needs” approach to improve the nutritional status of the population. Objectives included control of micronutrient deficiencies. Although anemia control was a clearly stated goal in Thailand’s Sixth National Plan in 1982, the country has not had a specific anemia control strategy. Instead, anemia control activities have been implemented at the suggestion of ad hoc technical committees.

□ **Identify potential collaborating groups (universities, government agencies, NGOs, civic groups, commercial entities)**

Organizations with interests and capabilities in anemia prevention and control are potential resources and collaborators. In addition to the health ministry, other ministries such as agriculture, education, and industry can contribute. Some NGOs will be able to link anemia to their organizational goals and missions – women’s and human rights organizations, for example, might consider protection from anemia a basic right and thus support and assist anemia prevention and control. For technical assistance, food industry specialists, regulatory specialists, social scientists, researchers in health and consumer behavior, program designers, communication experts, training experts, and monitoring and evaluation specialists are potential col-

In **India**, the National Human Rights Committee made a commitment to anemia prevention and control. Women’s and children’s groups, NGOs, the media, and the food, agriculture, and education sectors were also involved.

In **Indonesia**, a local religious leader promoted iron supplements for women.

In **Guatemala**, the anemia program surveyed millers to determine their interest in iron fortification and rally their support.

In **Thailand**, village volunteers were used to increase community commitment to and involvement in anemia programming.

laborators. All of these professionals should be approached for the added value they can bring to anemia prevention and control programs.

□ **Review existing programs and determine and develop anemia prevention and control activities**

Existing programs need to be reviewed to determine how anemia prevention and control is working and can be strengthened. This review should go beyond earlier formative research activities and identify specific anemia prevention and control activities in all sectors. Some activities are best implemented by and through certain sectors and existing programs; others are best implemented by coordinating across sectors. Examples of activities that can be added to health programs and programs in other social sectors are listed in **Sector-Specific Interventions to Prevent and Control Anemia**.

**Indonesia** used marriage registrations to target women who were about to be married. Other programs were established to reach target populations in factories and other workplaces. A partnership between a women’s health project and several pharmaceutical companies manufactured attractively packaged IFA supplements to appeal to more women, including postpartum women. Small community shops and village midwives sold the supplements. By the end of the project, 21 percent of women were buying these supplements.

**Cambodia** promoted iron supplementation as part of an entire ANC package of services. Prizes for health centers and clients who met program goals motivated women to take all their IFA supplements.

In **Kenya** and **Malawi**, antimalaria drugs given to pregnant women helped control anemia.

**Chile** used school lunch programs to introduce fortified foods. A special cookie for use in children’s school lunches was fortified with a type of highly absorbable iron.

In **India**, **Sri Lanka**, and **Zimbabwe**, a deworming component was recommended for anemia programming.

□ **Determine and secure staffing, funding, and other resources for implementing activities**

Once the program’s activities and collaborating organizations have been determined, a work plan and budget for implementing activities are necessary. Each activity must be fleshed out with descriptions of its timing, responsible parties, cost, and indicators of success. Each activity needs a management plan. Negotiations with partners and collaborating groups about their respective commitments are necessary for developing a mutually agreeable implementation plan.

□ **Develop a monitoring and evaluation plan**

Each activity also needs a monitoring and evaluation plan. Process, outcome, and impact indicators should be identified to measure the program’s achievement of its objectives or to indicate the need for

changes. Indicators should dovetail with existing information

**See “Selected Monitoring and Evaluation Indicators for Anemia Prevention and Control Programs” in Tools and Resources.**

systems – for example, if national information systems track the number of IFA supplements distributed to pregnant women, a similar indicator at the program level should be used.

**Indonesia** uses the number of pregnant women taking iron as an indicator in its national information system. National surveys have monitored the impact of anemia programming.

Monitoring and evaluation activities must be designed during the planning phase before program implementation begins. Resources and budgets have to be procured to ensure that monitoring and evaluation is carried out continuously and as planned. Monitoring and evaluation data must also be analyzed and reported in a timely manner that enables program and project managers to use the information to improve

program implementation and outcomes.

Monitoring should be an ongoing exercise, and a monitoring timeline should be developed in the planning stage.

Monitoring a program will provide information about effectiveness throughout program implementation by measuring how well benchmarks of progress are achieved. Program monitoring should occur at all levels, from central government agencies down to local community partners. It is imperative to use the information from each level to improve program implementation at all levels. Information should not be collected without a plan to use it for program improvements.

Evaluation is more rigorous and frequently includes impact indicators, such as actual changes in anemia prevalence. Evaluations should be used to improve the national program. Impact evaluations are needed to measure program effectiveness, adjust program components that are not working, and provide justification for continuing the program. These evaluations should be conducted periodically in the context of the larger anemia prevention and control program. Anemia rates should be measured, and information about the types of foods consumed should be collected. If iron status is selected as an indicator, iron status tests of population subsamples can be conducted to keep costs down.

# Taking Action: Developing a Strategy for Anemia Prevention and Control

## *Sector-Specific Interventions to Prevent and Control Anemia*

### **Nutrition**

#### **Micronutrient supplementation**

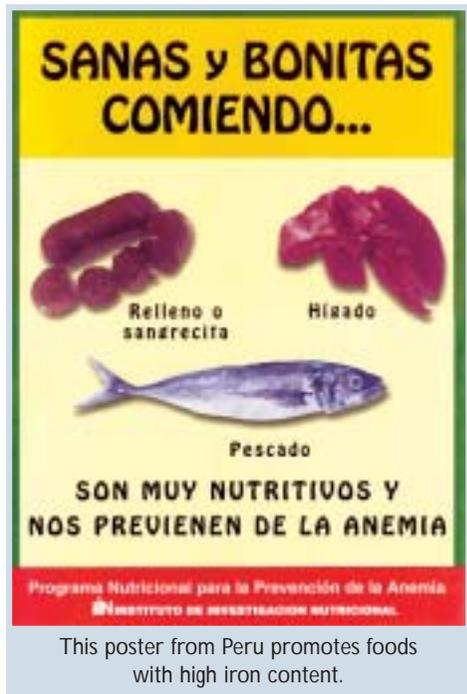
- Provide iron or IFA supplements to pregnant women and children 6 to 24 months of age
- As resources become available, provide IFA supplements to other vulnerable groups such as lactating women, school-age children, and adolescents
- To maximize iron absorption, counsel women to take IFA supplements between meals or before going to bed with a small amount of juice or water
- Counsel women about the importance of taking the full dose of IFA supplements and help them solve any problems they have in complying (such as managing side effects)
- Counsel women about the importance of giving their young children the full dose of IFA supplements between meals or before going to bed with a small amount of juice or water; help them solve any problems they have in complying
- Promote other vitamin, mineral, and nutrition supplements such as folic acid and vitamins A and B-12 to combat anemia caused by these nutritional deficiencies
- Use campaigns such as micronutrient days to promote anemia prevention and control and distribute IFA supplements

Because iron deficiency causes 50 percent of anemia worldwide, iron supplementation and fortification of staple and processed foods with iron are important elements of anemia prevention and control. See *Chapter III, Providing Iron Supplements to Combat Anemia*, and *Chapter IV, Improving Dietary Iron Intake to Combat Anemia*.

- Promote complementary interventions to reduce anemia, such as birth spacing and malaria and hookworm prevention and treatment

#### **Dietary approaches**

- Encourage consumption of fortified foods, if available
- Promote year-round production and collection of micronutrient-rich foods
- Counsel mothers that infants less than 6 months old should be exclusively breastfed to ensure adequate energy and micronutrient intake
- Disseminate information about adequate dietary intake of energy and micronutrients (particularly vitamin A, folic acid, vitamin B-12, and iron), especially to pregnant women and mothers of 6- to 24-month-old children



This poster from Peru promotes foods with high iron content.

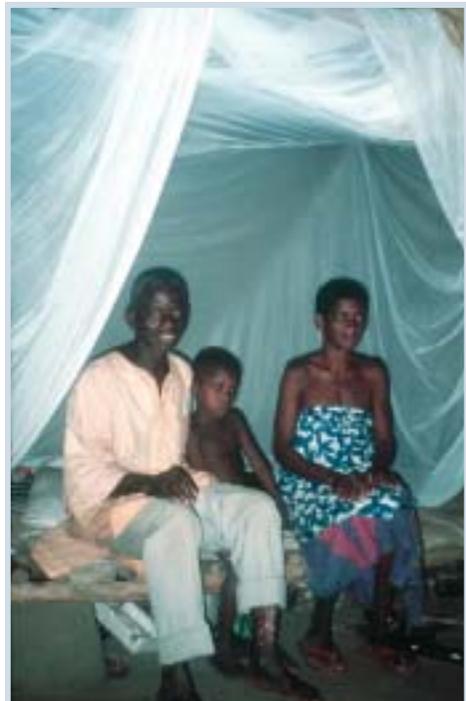
- Suggest that foods rich in vitamin C (such as fruits, tubers, and green leafy vegetables) be consumed at meal times. Vitamin C improves absorption of iron from plants that contain iron-absorption inhibitors such as phytates. Since vitamin C is quickly destroyed by exposure to air, foods should be prepared immediately before they are consumed and should not be overcooked.
- Educate families about the importance of animal products (meat, organs, or blood) in the diet. If animal products are available, children 6 to 24 months of age and pregnant women should have priority in consuming small amounts at mealtimes. Animal products not only provide iron that is well absorbed (20 to 30 percent is absorbed compared to less than 5 percent of the iron in plants) but also counter the effects of iron inhibitors in plant products. Animal products are also the only source of vitamin B-12, an important micronutrient for preventing anemia.
- Promote the consumption of legumes, which are excellent sources of folic acid
- Promote consumption of foods with adequate vitamin A activity (retinol from animal products or beta-carotene from plant products), because vitamin A deficiency can result in anemia. Foods containing vitamin A should be dried in the shade and receive minimal cooking to minimize loss of vitamin A activity. Greens containing vitamin A should be cooked just before they are served.
- Consume low-iron foods and iron-inhibiting foods in the same meals (for example, cereal-based porridge, which is low in iron and contains inhibitors of iron, can be consumed with milk and tea)
- Restrict consumption of tea, coffee, and cocoa to between meals or at least one hour after meals, since caffeine inhibits iron absorption
- Do not give tea, coffee, and cocoa to young children
- Consume milk and milk products as

between-meal snacks rather than at meals, since calcium in milk inhibits iron absorption

- Encourage food processing techniques (such as cooking, germinating, fermenting, and soaking of grains) that reduce factors that inhibit iron absorption
- Promote complementary interventions to reduce anemia, such as IFA supplementation, malaria and hookworm prevention and treatment, and birth spacing
- Evaluate the impact of these activities on anemia prevalence

### Infectious and Parasitic Diseases

- Provide rapid access to malaria treatment in areas of malaria transmission
- Encourage the use of insecticide-treated bednets, particularly by vulnerable groups, and teach how to re-treat nets with insecticides



An insecticide-treated bednet helps protect this family in the Gambia from malaria.

- Provide information on danger signs of malaria and hookworm, how to prevent them, and when and how to treat them

**See Tools and Resources for the table “Recommended Intermittent Presumptive Treatment (IPT) or Treatment Regimens for Malaria, Hookworm, and Schistosomiasis,” which notes the recommended iron dosages for people who have malaria, hookworm, or schistosomiasis.**

- Give intermittent presumptive treatment (IPT) for malaria to women, par-

ticularly those in their first or second pregnancy

- Treat malaria in young children with symptoms of fever or anemia

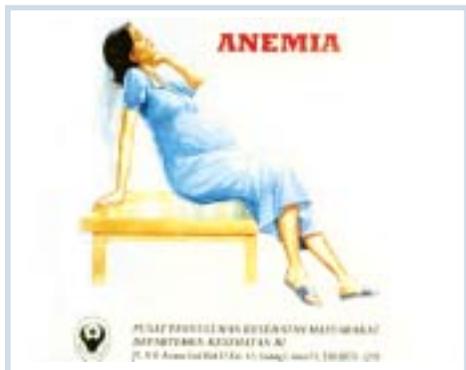
It has been estimated that treating malaria in young children who have symptoms of fever or anemia and giving intermittent presumptive treatment for malaria to women (particularly those in their first or second pregnancy) can increase hemoglobin by 1 to 3 g/dL.

- Provide hookworm medications
- Promote good sanitation practices, such as wearing shoes and using latrines
- Treat other infectious diseases, such as tuberculosis
- Promote and provide complementary interventions to reduce anemia, such as IFA supplementation, adequate dietary intake, and birth spacing
- Control diarrhea in young children
- Evaluate the impact of these activities on anemia prevalence

### Antenatal Care and Safe Motherhood

- Provide all pregnant women with IFA supplements and counsel them about taking the full dose
- In areas of low health service coverage, provide IFA supplements through community-based distribution or retail shops and use social marketing to promote sales of IFA supplements

- To prevent malaria-induced anemia, provide rapid treatment with effective medication to pregnant women who have malaria
- Provide IPT for malaria to pregnant women in malaria-endemic areas, especially women in their first or second pregnancy
- Provide presumptive hookworm treatment, starting in the second trimester, to pregnant women in hookworm-endemic areas
- Encourage pregnant women to sleep under insecticide-treated bednets
- Provide messages on good breastfeeding practices and good nutrition to antenatal and postpartum clients
- Train health workers about the dangers of anemia
- Train health workers how to manage complications and how to mitigate blood loss during delivery and in the postpartum period
- Provide safe blood transfusions for women with severe anemia
- Train staff to clamp the umbilical cord in newborns to increase their iron stores
- Evaluate the impact of these activities on anemia prevalence



This poster from Indonesia warns of the dangers of anemia during pregnancy.

## Family Planning and Reproductive Health

- Promote modern family planning methods to delay and space births, thereby preventing maternal iron depletion
- Promote and provide counseling on the Lactational Amenorrhea Method (LAM)<sup>1</sup> to women of reproductive age, particularly pregnant and newly delivered women
- Intensify efforts with adolescents to delay their first pregnancy, improve diet, and improve IFA status
- Use family planning extension and marketing activities to provide and promote other services addressing anemia, such as malaria and hookworm treatment, IFA supplementation, and improvement of dietary intake
- Prevent anemia and maternal iron depletion by placing IFA tablets in oral contraceptive packets to be taken during the “blank” week of oral contraceptive cycles
- Explain that preventing anemia and avoiding maternal iron depletion by consuming IFA supplements during the “blank” week of oral contraceptive cycles are added benefits of family planning
- Provide information about iron-saving contraceptives, such as Depo-Provera and certain oral contraceptives, to clients who have no contraindications to using them
- Provide training to ensure that intrauterine devices (IUDs) are properly inserted to mitigate blood loss; monitor blood loss of IUD users
- Evaluate the impact of these activities on anemia prevalence

## Child Health (including Integrated Management of Childhood Illness and Early Childhood Development)

- Provide caregivers with information on infant feeding, including good breastfeeding practices; timely introduction of complementary foods rich in iron, vitamin A, folic acid, and vitamin B-12; use of iron-fortified foods; and avoidance of substances inhibiting iron absorption
- Provide IFA supplements in the form of elixirs, drops, crushed tablets, spreads, or sprinkles through facility-based programs for all children under 2 years of age and for anemic children 2 to 5 years of age
- Counsel mothers to ensure compliance with the full supplement dose
- Provide children 6 to 59 months of age with semiannual doses of vitamin A in capsule form
- Use campaigns such as micronutrient days and national polio immunization days to promote anemia prevention
- Use community-based growth monitoring and promotion programs to counsel mothers on infant feeding and IFA supplements for their children 6 months to 2 years of age
- Integrate nutrition, health, and psychosocial stimulation in early childhood development programs; include actions to address anemia

***Under the Integrated Management of Childhood Illness (IMCI) protocol, each child health contact is used as an opportunity to address anemia. For access to IMCI materials, see the World Health Organization listing in “Information Sources for Anemia Prevention and Control” in Tools and Resources.***

<sup>1</sup> LAM is a method of delaying pregnancy based on the physiology of lactation. To use LAM, a woman must fully breastfeed, have not had return of menses, and be less than six months postpartum.

- Check for pallor of the palms. If positive, provide IFA supplements (elixirs, drops, crushed tablets, spreads, sprinkles). If the child lives in a malaria- or hookworm-endemic area, treat for malaria and hookworm.
- Immunize children against childhood diseases
- Manage diarrhea by continuing to feed children during diarrhea episodes and with oral rehydration therapy; children ages 6 to 24 months with bloody stools should receive extra iron
- Provide caregivers with information on danger signs of malaria and hookworm; counsel about malaria prevention through use of insecticide-treated bednets for children 6 months to 2 years of age and proper hygiene and sanitation practices
- Evaluate the impact of these activities on anemia prevalence

## Schools

- Include fortified foods in school feeding programs
- Teach schoolchildren about nutrient-rich indigenous foods
- In helminth-endemic areas, de-worm schoolchildren twice a year



In a school feeding program in Malawi, children receive porridge fortified with iron and other micronutrients.

- Provide IFA supplements, especially to adolescent girls, if fortified foods are not available
- Provide adolescent girls with information about family planning methods that can reduce menstrual blood loss, such as oral and injectable contraceptives, and methods that can increase blood loss, such as IUDs
- Include information in school curricula about anemia, good hygiene and sanitation, and the importance of IFA supplements, adequate diet, and insecticide-treated bednets
- Evaluate the impact of these activities on anemia prevalence

## HIV/AIDS Prevention and Treatment

- Promote a well-balanced diet for people living with HIV infection
- Promote dietary management for people living with AIDS, including adequate dietary intake of energy and micronutrients (particularly vitamins A and B-12 and folic acid) and IFA supplements to stimulate red blood cell production and combat anorexia caused by iron deficiency
- Give presumptive malaria treatment to pregnant women living with HIV/AIDS in malaria-endemic areas
- Diagnose people living with HIV/AIDS for other diseases that contribute to anemia (e.g., hookworm, diarrhea, tuberculosis) and treat them appropriately
- To mitigate risks of HIV transmission, limit intravenous blood transfusions for severe anemia to clients who do not respond to other ways to increase their hemoglobin
- Evaluate the impact of these activities on anemia prevalence in people living with HIV/AIDS

## Food Aid and Security

- Fortify food aid cereals with iron and other micronutrients
- Use monetized food aid to provide program support for anemia control
- Provide IFA supplements in areas where food aid is available
- Where food is made available at health services or through schools, make sure it is fortified with iron and that nutrition interventions (including IFA tablets) and education are also available
- Identify, promote, and produce varieties of staple foods that are high in iron (bio-fortification)
- Evaluate the impact of these activities on anemia prevalence
- Develop, produce, and market foods fortified with iron and/or other micronutrients for specific vulnerable groups, particularly young children
- Develop, produce, and market IFA and other micronutrient supplements that address all nutritional causes of anemia
- Encourage food suppliers to market fortified foods and pharmaceutical suppliers to market IFA and other micronutrient supplements
- In areas where malaria or hookworm are endemic, promote and market insecticide-treated bednets, de-worming and antimalaria medication, and appropriate footwear
- Market contraceptives at the community level

## Environmental Health

- Discourage the use of night soil (human feces) as fertilizers
- Provide potable water
- Promote the use of sanitation facilities to reduce transmission of hookworm and other helminths
- Support programs to eliminate use of leaded gasoline and lead-based paints
- Eradicate conditions that breed mosquitoes
- Modify water habitats to prevent breeding of snails that carry schistosoma
- Evaluate the impact of these activities on anemia prevalence
- Fortify foods used in school feeding programs with iron, folic acid, and vitamins A and B-12
- Investigate the feasibility of developing and marketing fortified foods that can be targeted to children 6 months to 2 years of age
- Evaluate the impact of these activities on anemia prevalence

## Commercial Sector: Food and Pharmaceutical Manufacturers, Marketers, and Distributors

- Develop, produce, and market foods fortified with iron and/or other micronutrients (including folic acid, vitamin B-12, and vitamin A) for the general population



## Chapter III Providing Iron Supplements to Combat Anemia

Because iron deficiency is the major cause of anemia (see *Chapter I, Anemia: “Lost Years of Healthy Life”*), providing iron supplements (often with folic acid added) to vulnerable groups is a key intervention in anemia prevention and control. Iron supplements and fortified foods targeted to pregnant women and children 6 months to 2 years of age will always be necessary because these groups have such high iron requirements. Supplementation in these two groups, along with fortification of a staple food with iron, is the most cost-effective means of addressing iron-deficiency anemia in most developing countries. If it is not possible to fortify a staple food for the general population (see *Chapter IV, Improving Dietary Iron Intake to Combat Anemia*), iron supplements for high-risk groups such as school children, adolescent girls, and postpartum women will be needed in addition to supplements for pregnant women and young children.

Efforts to provide iron supplements should be part of a country’s overall anemia strategy (see **Sector-Specific Interventions** in *Chapter II, Taking Action: Developing an Anemia Prevention and Control Strategy*). For iron supplementation programs to succeed, appropriate government agencies must work with one another and with the private sector to provide iron or iron-folic acid (IFA) supplements appropriate to the country’s specific anemia problem. Managers of health-related programs need to be included in planning so they can provide accurate estimates of the quantities of supplements required to meet the iron needs of the target populations. These managers can also help address the tasks of making supplements affordable, available, and accessible to those populations.

Planning should also include research to develop effective messages to ensure



IFA supplements can be packaged and distributed in a number of ways.

clients take iron or IFA supplements and to determine the best ways to get supplements to users through either public or private sector channels. Public and private sector distributors need to develop ways to monitor and evaluate their efforts.

Effectively implementing interventions of any kind requires an integrated approach with financial, political, and technical commitment and support. The key to the immediate success and long-term sustainability of an iron supplementation program is the support of government at all levels – national, provincial/state, and local – and, where needed, international organizations.

This chapter includes a **Country Example** from Thailand that describes how the country improved iron supplementation for pregnant women and effectively decreased anemia prevalence in that group. In addition, the **Country Example** preceding *Chapter I* describes Bolivia’s iron supplementation program, some of the constraints it has faced, and possible solutions.

The **Good Practices Checklist** gives steps for designing iron supplementation programs presented in a suggested order of implementation. The **Good Practices in Detail** section describes the specific actions that managers, concerned policy makers, and others should take in each step as they design and implement iron supplementation programs. It is based on a review of good practices of existing programs. *Part II* of this document, **Tools**

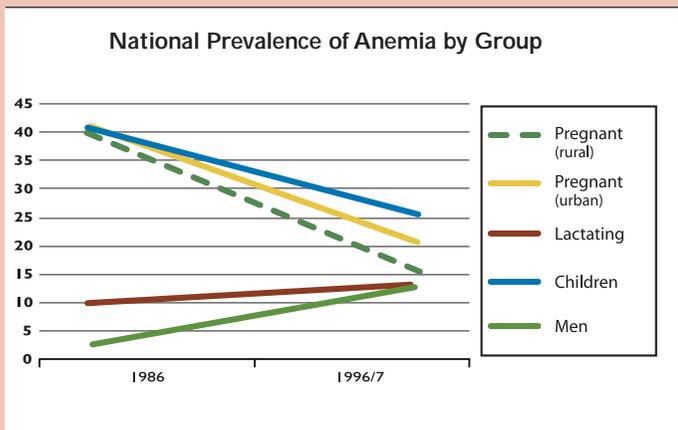
**and Resources**, provides research instruments and methodologies, background data, norms and protocols, and references to help program and project managers design interventions.

## COUNTRY EXAMPLE

# ANEMIA PREVENTION AND CONTROL IN THAILAND

Over the past several decades, Thailand has dramatically reduced the prevalence of undernutrition in children under 5 years old. While rapid economic growth (7 percent per year) over the past 20 years may have contributed to some of this reduction, targeted nutrition programs aimed at reducing undernutrition and micronutrient deficiencies were the major factors in this success.

More recently, Thailand has made great strides in reducing anemia prevalence, although this has been little publicized in the international community. Between 1986 and 1996/97, national surveys showed that anemia prevalence in pregnant women fell from 40 to 15.5 percent in rural areas and from 41 to 20.5 percent in urban areas (see figure). These declines represent a greater than



50 percent reduction in anemia among pregnant women. Anemia in children less than 5 years old also declined, from 40.6 to 25.2 percent (a 38 percent reduction) during this period. In men and lactating women, however, anemia prevalence increased.

Thailand made an early commitment to anemia control, citing it as a major nutrition problem as early as 1982 and establishing anemia reduction as a national goal. Although Thailand has never had a permanent national committee for anemia control, it has used ad hoc committees of scientists and program managers to examine and discuss issues related to anemia prevention and control.

To reduce anemia among pregnant women, Thailand took the following actions:

- Increased the early use of antenatal care (ANC) services. With the help of 500,000 village health volunteers, 98 percent of women receive ANC and 84 percent make at least four ANC visits. The volunteers identify pregnant women and encourage them to obtain ANC services immediately.
- Provided iron-folic acid (IFA) supplements to all pregnant women, regardless of their hemoglobin levels
- Used qualitative research findings to improve communication and help health workers counsel women taking IFA supplements
- Decentralized the supply and logistics of IFA supplements by permitting provincial offices to estimate their own needs and provided easily accessible back-up supplies

- Monitored anemia prevalence in young children and women at public health service facilities

To further reduce anemia, Thailand could improve health worker training and monitoring of compliance with IFA supplementation. In addition, programs targeted at children less than 2 years old are needed. While there has been progress in reducing anemia in children under age 5, most of this reduction has come from improvements in maternal iron status and by increasing young children's intake of foods containing absorbable iron. More targeted efforts are underway with pilot testing of fortified foods and iron sprinkle supplements to find effective interventions for the under-2 age group as well.

# Providing Iron Supplements to Combat Anemia

## Good Practices Checklist

*(Note: These steps are presented in a suggested order of implementation.)*

### CONDUCT INITIAL FORMATIVE RESEARCH WITH CONSUMERS AND PROGRAM MANAGERS

- ❑ Develop a research instrument, conduct field research, and review results

### DETERMINE AND PROVIDE THE APPROPRIATE IRON AND FOLIC ACID DOSES

- ❑ Determine if iron and folic acid doses in current supplements conform to international recommendations
- ❑ Consider adding other micronutrients to the supplement

### INCREASE DEMAND AND ENSURE COMPLIANCE

- ❑ Conduct qualitative research on attitudes and behaviors related to anemia and iron-folic acid (IFA) supplementation
- ❑ Ensure that the characteristics (color, taste, size) of IFA tablets, elixirs, and other types of supplements are acceptable to users
- ❑ Develop attractive yet affordable packaging
- ❑ Develop and deliver effective messages to overcome consumer resistance and ensure compliance in taking IFA supplements

### IMPROVE SUPPLIES AND DISTRIBUTION

- ❑ Estimate the quantities of IFA supplements needed for target groups
- ❑ Improve the logistics for delivering IFA supplements
- ❑ Increase the use of antenatal care and child health services
- ❑ Provide a buffer stock or other back-up sources of IFA supplements
- ❑ Provide IFA supplements through community-based and private/retail outlets

### MONITOR AND EVALUATE IRON SUPPLEMENTATION PROGRAMS

- ❑ Incorporate indicators for monitoring and evaluating IFA coverage/compliance into program monitoring and evaluation



# Providing Iron Supplements to Combat Anemia

## Good Practices in Detail

### Conduct Initial Formative Research With Consumers and Program Managers

- **Develop a research instrument, conduct field research, and review results**

Conducting early formative research will inform program managers about the status of current supplementation activities and the need for changes and new activities. The research should cover the extent and success of coverage, supplies, the distribution system, the importance of anemia in the minds of policymakers, consumer perceptions of anemia, and consumer knowledge of supplementation programs. The initial research carried out in developing the overall anemia strategy can include iron supplementation (see **Know the problem ... in Chapter II**). This will give an overview of the situation that can enhance more detailed subsequent qualitative research to increase demand and ensure compliance through public promotion and client counseling.

The first step is to develop a research instrument that is primarily qualitative in nature. Quantitative data on national supplement supplies and the proportion of health and other workers trained in anemia control are also useful. A specialist in communications or marketing should conduct the research at the national, provincial/state, and community levels. The research results should be discussed with policymakers, program managers from the various professional sectors interested in anemia prevention and control, donors, and representatives from civil society to gain their insights about overcoming program constraints and integrating program activities (see **Raise awareness and develop partnerships in Chapter II**).

### Determine and Provide the Appropriate Iron and Folic Acid Doses

- **Determine if iron and folic acid doses in current supplements conform to international recommendations**

Program personnel should determine if current iron and folic acid doses meet internationally

*Tools and Resources contains the tables “Iron and Folic Acid Doses for Universal Supplementation in Vulnerable Groups” and “Iron and Folic Acid Doses for Treating Severe Anemia in Vulnerable Groups.”*

accepted standards. These doses differ depending on the prevalence and severity of anemia and the group affected by it. The World Health Organization provides the gold standard for doses of iron and folic acid in supplements for different groups.

If the iron doses in the current supplements are not included on package labels or are not clear, laboratory tests should be conducted to determine the dose. These tests should determine the amount of elemental iron in the supplement, not the amount of the compound (such as ferrous sulfate) used to deliver the iron. If the current doses do not meet requirements and international recommendations, norms and protocols must be changed to recommend the appropriate doses.

For pregnant women, the recommended iron dose has decreased in recent years from a five-month regimen during pregnancy of two daily iron-folic acid (IFA) supplements each containing the equivalent of 60 mg of elemental iron (for a total of 18,000 mg) to a six-month regimen of one daily 60-mg supplement (10,800 mg). For postpartum women in areas of high

anemia prevalence, an additional three months of daily supplements is recommended. Although studies show that a

***Tools and Resources contains the table “Iron Doses and Three-Month Hemoglobin Increase in Women.”***

120-mg dose of elemental iron raises hemoglobin levels more than a 60-mg dose, the change to the lower dose for pregnant women was made in order to decrease the side effects associated with higher doses. Slow-release iron tablets have also been shown to reduce side effects. These tablets are not widely available in developing countries, however, and their effect on compliance is unclear. Counseling women about managing side effects may be more effective at improving compliance.

Because of their high iron requirements, pregnant women need to take iron on a daily basis. One 60-mg supplement per day may not be enough to significantly reduce anemia prevalence during and after pregnancy, particularly where the incidence of severe anemia is high. The effectiveness of the daily dose should be monitored. While it is most cost-effective to give a presumptive routine dose for anemia in areas of high anemia prevalence, screening women and young children for severe anemia is recommended so they can receive additional iron and follow-up if necessary. Clinical tests for pallor can be used in resource-poor settings and hemoglobin tests can be used where supplies and labo-

ratory facilities are available. If two or more daily doses are prescribed for women with severe anemia, they should be taken at different times of day to enhance effectiveness and minimize side effects.

For most groups other than pregnant women, weekly iron doses may be helpful in improving iron status. While an analysis of studies of dosing regimens concluded that pregnant women, and probably young children, need daily doses, it also suggested that weekly doses may be provided to schoolchildren, adolescents, and nonpregnant women under supervised settings.

The recommended dose of folic acid has increased, from 250 to 400 mcg, following findings that women have higher folic acid requirements than previously thought. The increased dose improves folic acid status, helping to prevent macrocytic anemia, which is caused by a deficiency of folic acid.

**□ Consider adding other micronutrients to the supplement**

If other nutritional deficits (such as insufficient vitamin A, B-12, C, riboflavin, or the mineral copper) are causing or contributing to anemia, a supplement containing iron and

the appropriate micronutrients, if available, should be provided. If tablets

***Tools and Resources contains the table “United States Recommended Dietary Allowances of Anemia-Related Micronutrients (Other Than Iron and Folic Acid) for Vulnerable Groups.”***

combining the required micronutrients in appropriate doses do not exist or are not available, programs should provide standard-dose IFA supplements until the multimicronutrient supplements become available. As multimicronutrient supplements are developed, they should contain adequate iron for the target vulnerable population (for example, 60 mg for pregnant women).



A clinic worker examines a client's fingernail beds for pallor, a sign of anemia.

## Increase Demand and Ensure Compliance

### □ Conduct qualitative research on attitudes and behaviors related to anemia and IFA supplementation

Qualitative research is an excellent tool for identifying barriers to and facilitators of IFA supplementation, both among clients and health workers, and for designing program improvements. Ideally, it should be conducted as part of anemia program planning, but it may also be conducted independently (see **Know the problem ... in Chapter II**).

Qualitative research can provide information that will suggest communication strategies to promote behavior change and compliance with IFA supplementation regimens. In a number of countries, qualitative research has studied the reported side effects of IFA supplements as an obstacle

*The Trials of Improved Practices, or TIPS, methodology is part of the “Qualitative Research Instrument on Perceptions of Anemia and Use of Iron Supplements – The Indramayu Project, Indonesia” that appears in Tools and Resources. The Project used TIPS to test recommendations about IFA supplements with mothers and other women and determine barriers to their use.*

associated with a 60-mg dose of elemental iron do not deter users as once thought. Other qualitative research efforts have reported high compliance with IFA supplements even in unsupervised settings. Such research also can determine the acceptability and feasibility of alternative supply channels (such as community-based providers), ascertain the willingness of clients to pay for supplements, and estimate how much they can and will pay.

to demand for and compliance with iron supplementation. The research has generally found that the side effects

In a qualitative research study in **Thailand**, 10 to 30 percent of pregnant women taking IFA supplements reported side effects, but most found they subsided in a few days and continued to take the supplements.

In **Andra Pradesh, India**, 80 percent of women reported consuming all the IFA supplements or syrup they were given.

Qualitative research in **Sri Lanka** and **Tanzania** found that side effects were not a major problem among girls who were given IFA supplements.

In **Tanzania**, compliance among girls taking IFA supplements increased to 90 percent when their parents (who feared they were taking contraceptives) were made aware of the true contents of the supplements.

In **Indonesia**, 98 percent of pregnant women took at least some supplements. On average, they took 66 of the recommended 90 tablets.

### □ Ensure that the characteristics (color, taste, size) of IFA tablets, elixirs, and other types of supplements are acceptable to users

IFA supplements need to be acceptable to consumers, and programs need to develop and use IFA supplements that are attractive in size, color, taste, and smell. Attractive qualities enhance compliance and communicate the message that IFA supplements are products of high value. Qualitative research can provide information about consumer preferences.

Supplements in the form of a small film- or sugar-coated red tablet may be more acceptable to women. Small tablets are easier to swallow than the large tablets commonly used in many countries. A sugar or film coating can mitigate the “fishy” taste and smell that women complain about with uncoated tablets. IFA supplements that are red or a shade of red may be attractive because women in many countries associate red with powerful or healthy blood. The most acceptable color may vary from culture to culture, however.

It is less clear what type of supplements mothers prefer to give their young children. Iron tablets for young children need to be crushed to make them easier to swallow. Different preparations of iron supplements that are more palatable to children than tablets (such as elixirs, syrups, drops, and recently developed sprinkles for adding to or putting on food) are available, although they often cost more.

*Thailand* introduced a small sugar-coated red tablet that was easy to swallow.

### □ Develop attractive yet affordable packaging

Women prefer attractive and convenient packaging to newspaper or other paper wrappings, which in humid climates do not protect supplements from breaking, cracking, or melting. Blister packaging is a popular type of packaging but may be expensive. Programs should carefully weigh budgetary decisions to use it or not against other program needs.

Packaging should be distinctive so that IFA supplements are not confused with other medications or products such as contraceptives. Supplement packaging should be specific to the targeted group, with pictures and specific messages for that group included on the package. The package should give clear information about the number of tablets to take, how often they should be taken, and why. Tablet packs should be childproof to prevent young children from opening them and ingesting the tablets. They should also give adult

In *Bolivia*, a pilot project provided IFA supplements in small film containers. This protected the tablets from disintegrating and appeared to increase the value of the supplements in women's minds and increase demand.

*Indonesia* used attractive lettering and color designs on its packaging and changed to foil sachets to prevent tablets from disintegrating.

*Mali* and *Senegal* used blister packs to make supplements more attractive and last longer in storage.



Red sugar-coated iron tablets are popular in many countries. Protective packaging is preferred to paper, however.

caregivers clear instructions to keep the supplements out of the reach of children. Qualitative research can determine consumers' packaging preferences.

IFA supplements should be affordable. Research with target groups can help determine if and at what price clients are willing to buy supplements. Government policies can determine sales and pricing policies. If IFA supplements cannot be made affordable for target groups, their costs may be covered with other health services or they may be provided free.

In *Indonesia*, the government approved consistent pricing policies to support private sector sales of IFA supplements.

In *Bolivia*, the cost of IFA supplements was included in the cost of ANC services purchased by most women.

In *Thailand*, IFA supplements were provided free, with costs of anemia tests for poor women covered by the welfare system.

Programs in *Caribbean countries* have financed IFA tablet supplies through an ANC package that women were required to buy.

### □ Develop and deliver effective messages to overcome consumer resistance and ensure compliance in taking IFA supplements

Effective messages to promote compliance with IFA supplementation regimens should be based on in-depth qualitative research with the target population.

In **India**, women were given a red rose, which attracted them to the program and also promoted the red color of iron pills. Information, education, and communication (IEC) efforts and counseling messages were improved to dispel worries and encourage continuation. Follow-up visits by providers to new clients, particularly in the first two weeks of taking supplements, helped reinforce messages.

**Bolivia** and **Indonesia** also improved IEC and counseling messages.

In **Thailand**, **Indonesia**, **Bolivia**, and **Malawi**, women were given calendars to help them remember to take their iron supplements daily.

To improve compliance in **Malawi**, IFA supplements were promoted as a nutrition supplement rather than a medication. They were taken as instructed by 86 percent of women.

Messages should be developed to address clients' perceptions of anemia, concerns about iron supplements, packaging preferences, and so on. In some cultures, anemia itself is not a recognized term; instead, its signs and symptoms are recognized. Women may report both positive and negative experiences with IFA supplements, as these comments from several countries suggest:

- **Improved well-being:** “Because of the iron supplements every day I feel better. I feel like doing everything. Now I am eating better and I have gained a little weight.” – **Bolivia**
- **Tablet characteristics:** “The medicine has the smell of blood, but that didn't worry me because they are helpful and good.” – **Malawi**
- **Fears:** “I don't take iron supplements to avoid a big baby and suffering at delivery.” – **Honduras**
- **Inadequate counseling:** “They just gave the supplements; they don't give instructions.” – **India**
- **Suspicion:** “We prefer to go to the private doctor and buy supplements.” – **India**

- **Economic barriers:** “Vitamins increase the appetite. If we don't have anything to eat, why would we want to become more hungry?” – **Honduras**
- **Forgetfulness:** “If I take it while eating, I remember, but sometimes after eating I must return to work quickly, so I forget.” – **Indonesia**

Messages can be delivered through social marketing, advocacy campaigns, and counseling. Good counseling by health workers includes “negotiating” with



This poster from Honduras promotes iron drops and citrus fruits and juices for young children while discouraging tea and coffee.

women and mothers to follow instructions and giving them advice about how to take iron supplements and how to give them to their children. These are essential to improve compliance. Follow-up counseling and reminders like calendars to reinforce messages and help women remember to take their supplements have been popular in many programs. They can help overcome the drudgery of taking a supplement for a long time, which reduces compliance to about 50 percent over the long term. Follow-up reminders also may be needed for mothers

***In Tools and Resources, see “Counseling Pregnant Women and Mothers About Iron Supplements,” which gives counseling points and shows sample counseling cards from Indonesia, and “Negotiating With Women to Follow Advice.”***



This calendar card from Bolivia helps women remember to take their IFA tablets daily.

who are giving their children daily IFA supplements.

Training health workers how to counsel women receiving iron supplements is especially important, as many women may perceive the quality of care as poor if health providers have poor interpersonal skills. Supervisors need to ensure that workers adhere to training messages. On-the-job training to reinforce more formal training should be a recurring activity.

## Improve Supplies and Distribution

### □ Estimate the quantities of IFA supplements needed for target groups

Ensuring that a continuous adequate supply of IFA supplements is available to tar-

get populations is essential for a successful program. Inadequate supplement supply has been the largest obstacle to success for many programs. To determine the quantities of IFA supplements needed, drug procurement personnel need accurate estimates of the size of each target group. In areas where ANC use is high, estimates of the number of pregnant women can be based on the number of women using ANC services. If ANC use is low, needs estimates for supplements should not be based on the number of pregnant women, because this may lead to an oversupply at each level of the health system. If community supplies of supplements are available, needs can be estimated using the number of pregnant women as indicated by population size and fertility rates. Estimates of the number of young children should also be based on birth rates. A decentralized process of estimating the size of target groups provides more accurate estimates.

In **Thailand**, IFA requirements are estimated at the provincial level, not the national level. The estimates are based on the number of pregnant women in the province or the number using ANC services, which works well because ANC use is high.

In **Grenada, St. Vincent, and the Grenadines**, the iron status of pregnant women improved only when supplies of supplements increased and a continuous supply was ensured.

### □ Improve the logistics for delivering IFA supplements

Bottlenecks in logistics and supply systems for IFA supplements must be identified and cleared. It is probably most effective to do this in coordination with efforts to improve the distribution logistics for other essential drugs. The needs of different

**India** decentralized its supply system to the state and district level and created a special unit to monitor supplies.

**Indonesia** decentralized its IFA supply system to the province level, which reduced travel time when orders were placed and ensured supplies were available to meet local needs.

distribution channels for IFA supplements, such as schools and private sector channels, should be assessed. Storing stocks of IFA supplements at lower levels in the supply system (the district level, for example) facilitates procurement for health centers and other distributors.

### □ **Increase the use of antenatal care and child health services**

In many countries, use of antenatal care (ANC) services is low or begins too late in pregnancy to supply all the services needed by pregnant women, including IFA supplements. Increased use of ANC services will increase the number of women who receive iron. In many countries, IFA supplements have been used to attract women to ANC services.

In **Thailand**, ANC coverage has increased because 500,000 community volunteers identify women early in pregnancy and encourage them to use ANC. More than 98 percent of women have at least one ANC visit and 84 percent have at least four visits. Iron supplements are routine for all pregnant women regardless of their hemoglobin level and diet. Clear protocols on IFA supplements, increased iron for severely anemic women, and physician follow-up are included in ANC manuals.

In order to deliver iron to children 6 to 24 months of age, child health services need to expand their activities beyond their focus on immunizations for children under 12 months. This can be accomplished through outreach services or special micronutrient days during which micronutrients are distributed.

### □ **Provide a buffer stock or other back-up sources of IFA supplements**

To ensure continuity of supplies, an additional buffer stock of 20 percent of the estimated need should be provided. Other back-up supply mechanisms, such as revolving drug funds, can also be arranged. The procedures for obtaining additional supplies from these sources should be straightforward and not require approval from central levels.

In **Thailand**, there are several easily accessible sources of IFA supplements, including a fund for the poor and a revolving fund for purchasing health commodities.

In **Malawi**, a World Bank project financed additional IFA supplements.

### □ **Provide IFA supplements through community-based and private/retail outlets**

IFA supplements should be made available through community-based distribution or sales outlets, especially in areas of low ANC and child health coverage or poor services. Community-based workers must be trained to counsel clients and give them the recommended number of tablets. Communities may need to be assured of the workers' competence.

In some countries, private sector workplaces are providing IFA supplements. Programs should make every effort to produce or import supplies of affordable IFA supplements for local sale.

In **Cambodia** and **Indonesia**, workplaces such as factories and plantations provide IFA supplements to improve the health and productivity of women workers.

**Indonesia** increased community distribution of IFA supplements in areas of low ANC use. Village midwives distributed IFA supplements to women, and small shops and community workers also sold them.

In **India**, community health workers have delivered IFA supplements during community visits. In one NGO project, clinics distributed supplements and provided information on obtaining additional supplies from other sources, including the village health nurse, health subcenters, and primary health care facilities.

In **Malawi**, traditional birth attendants have provided IFA supplements. Local markets identified as acceptable by clients are alternative sources.

In **Honduras**, volunteers in growth monitoring and promotion programs have distributed an iron supplement syrup to mothers of children under age 2.

# Monitor and Evaluate Iron Supplementation Programs

## □ Incorporate indicators for monitoring and evaluating IFA coverage/compliance into program monitoring and evaluation

Monitoring and evaluation activities should be designed and incorporated into IFA supplementation from the outset of strategy and program planning. (See **Develop a monitoring and evaluation plan ... in Chapter II**). Monitoring is an ongoing exercise, while evaluation may take the form of cross-sectional studies of anemia prevalence and other key indicators taken every few years. Data collected by these activities must be reported and analyzed in a timely manner to have positive impacts on programs.

Anemia prevalence is the most appropriate impact indicator for evaluating the effectiveness of anemia prevention and control programs. Measuring changes in iron deficiency in a population is the best indicator of the impact of IFA supplementation programs, but it is expensive and not appropriate in a field setting. Collecting information in smaller subpopulations can provide information on progress in reducing iron-deficiency anemia at less cost.

Because the success of IFA supplementation programs depends on supply and demand, indicators should include the proportion of pregnant women, children 6 months to 2 years old, and other identified target populations who are:

- Receiving any supplements (reflecting supply and maybe demand if there has been a campaign to promote IFA supplements)
- Receiving the recommended number of supplements (reflecting supply and quality of services)
- Purchasing supplements (reflecting supply and demand)
- Reporting they took (or gave to their children) all the supplements they

received (reflecting demand and compliance)

These indicators can be collected by checking the records of the supplement quantities distributed to different population groups by health facilities, health outreach programs, schools, and others, and by interviewing pregnant women, mothers, and others about the supplements they received and took. Counting leftover tablets is often used to determine compliance. In

some areas, biological markers such as iron in stool sam-

ples have been used, but such advanced measures usually require access to laboratories and are seldom feasible in resource-poor settings. They are also expensive and may be culturally unacceptable.

Self-monitoring can also be effective. For example, a woman receives a reminder card with her supplements and records on it how many supplements she has taken. Providers can ask women to bring these cards back to record compliance. Such contact also provides an opportunity for health workers to reinforce the importance of taking IFA supplements every day.

***For more indicators see “Selected Monitoring and Evaluation Indicators for Anemia Prevention and Control Programs” in Tools and Resources.***

In **Bolivia**, a program provided supplements in small containers and asked women to bring the containers at their next visits, when tablets were counted and compliance recorded.

**Thailand** counted iron tablets as a measure of compliance when women came in for follow-up ANC visits.

**India** made monitoring an integral part of its iron supplementation program by including indicators related to distribution of iron supplements in the national information system.

## Chapter IV

# Improving Dietary Iron Intake to Combat Anemia

Because iron deficiency is the major cause of anemia (see **Chapter I, Anemia: “Lost Years of Healthy Life”**), improving dietary intake of iron – mainly through food fortification – is another key intervention in anemia prevention and control.

Fortification of staple foods with iron is the major way to increase dietary intake of iron in countries where iron-rich foods are too expensive for the poor to purchase. Where it has been evaluated, fortifying foods with iron has been found to increase dietary intake of iron, improve iron status, and reduce anemia prevalence in specific populations. While other means of improving dietary intake are also possible and should be part of anemia prevention and control (see **Sector-Specific Interventions in Chapter II, Taking Action: Developing a Strategy for Anemia Prevention and Control**), food fortification should also be part of a country’s overall anemia strategy.

For the most part, food fortification efforts in developing countries have been slow to take shape because food industries are not well developed and because vulnerable groups do not widely consume centrally processed foods. However, as processed foods become more available, anemia prevention and control programs should make efforts to ensure they are fortified and targeted to vulnerable groups. This can only occur if food manufacturers, distributors, and retailers are engaged as full partners with the public sector and civil society. Establishing public-private partnerships to develop and implement food fortification strategies is essential and should be one of the first steps in planning an anemia prevention and control strategy that includes food fortification.

Planning needs to include market research to develop iron-fortified food products,



Fortifying food staples and condiments with iron can help protect children against anemia.

develop messages to convince populations to consume these products, and determine the best ways to get them to target populations, either through public or private sector channels. All involved parties need to develop ways to monitor and evaluate their efforts.

Effectively implementing interventions requires an integrated approach with financial, political, and technical commitment and support. The key to the immediate success and long-term sustainability of a food fortification program is the support of government at all levels – national, provincial/state, and local – and, where needed, international organizations.

This chapter’s **Country Example** describes Venezuela’s experience with food fortification. The **Good Practices Checklist** then gives the steps for initiating and building food fortification programs in a suggested order of implementation. The **Good Practices in Detail** section further describes these steps and the specific actions that managers, concerned policy-

makers, and others can take to design and implement programs. It is based on a review of good practices of existing programs. Good practices for iron supplementation are discussed in **Chapter III, Providing Iron Supplements to Combat Anemia.**

In **Tools and Resources (Part II of Anemia Prevention and Control: What Works)**, background data, research instruments and methodologies, norms and protocols, and references for additional information are provided to help managers plan and implement interventions.

## ***COUNTRY EXAMPLE***

### **IRON FORTIFICATION OF STAPLE FOODS IN VENEZUELA**

In the 1990s, national statistics on food production and consumption in Venezuela suggested that iron and some vitamins were becoming less available in the country's food supply. In response, the government embarked on a program to fortify widely consumed foods with iron and other micronutrients. Precooked corn flour, precooked wheat flour, and wheat flour used for making bread were identified as the best vehicles for fortification because they are consumed by the entire population and make up a large portion of the diet of Venezuela's poor populations. For example, an estimated 45 percent of the calories consumed by people in the lowest socioeconomic group come from these foods.

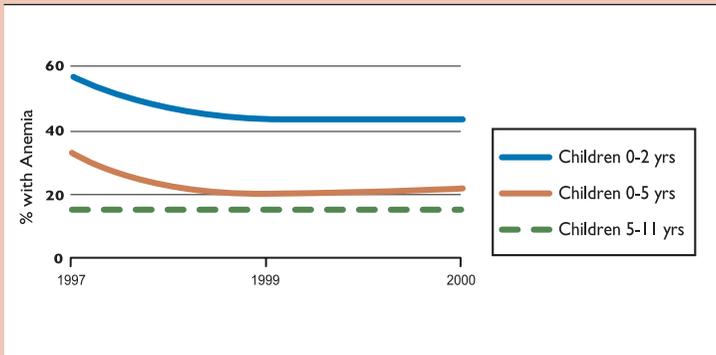
Precooked fortified flours started reaching the population in February 1993; by August, wheat flour for bread was being fortified. At first, precooked flours provided 50 mg of iron, as ferrous fumarate, per kilogram, as well as vitamin A, thiamin, riboflavin, and niacin. They were later changed to provide 30 mg of iron per kilogram as ferrous fumarate and 20 mg per kilogram as electrolytic iron. Fortification of wheat flour for bread started with additions of iron (20 mg per kilogram as ferrous fumarate), plus thiamin, riboflavin, and niacin. As a result of education about the seriousness of micronutrient malnutrition, some companies began to voluntarily fortify foods such as breakfast cereals and infant foods. This increased the general availability of fortified foods.

Issues such as consumer acceptability and fortificant costs were addressed early in the program. For most of the population, consumer acceptability was high because there were few changes in the appearance, taste, or cooking properties of the fortified foods. However, in two regions where the mineral content of water was high, corn bread baked with fortified flour came out noticeably darker. This occurred only with 1 percent of the population, but to ensure that the products were acceptable to everyone, ferrous fumarate was substituted for electrolytic iron. This caused fewer changes in the appearance of corn bread in the affected areas.

The cost of adding these fortificants to these flours was less than 1 percent of the market-selling price. After educational and partnering initiatives with the private sector, industry agreed to completely absorb the cost.

Both the food industry and the government monitor fortificant levels. Industry monitors the fortification mix and the amount of iron in the product at the factory and consumer levels. The government also monitors the amount of iron at the consumer level and determines the impact of the program through annual surveys. During the first two years of the program, anemia prevalence decreased in the groups monitored. After that, anemia prevalence did not decrease, even though iron stores of the Venezuelan population continued to improve. Despite initial gains in reducing anemia prevalence, the true impact of fortification in Venezuela needs further evaluation because the methodologies of studies to evaluate its impact were difficult to compare. It may be that anemia prevalence did not decline further because of a change to the more stable but less absorbable electrolytic iron, a 10 percent decline in the sale and consumption of some of the fortified products, or an increase in parasitic infections.

## Decline in Anemia Prevalence in Children, 1997-2000



The main factors identified as responsible for the success of Venezuela's iron fortification program are:

- The choice of the most effective iron compound based on absorption, cost, consumer acceptability of the fortified product, and the prevalence levels of anemia and iron deficiency
- The choice of a food for fortification that was centrally processed and consumed by most of the population, including the poor, with little variation in consumption throughout the year
- Flexibility in norms and legislation, so that changes could easily be made to program components (such as changes in the amount of iron or type of compound used)
- Monitoring of the amount of iron in fortified foods at the production and retail levels
- Measurement of the impact of the program on national anemia and/or iron deficiency levels

# Improving Dietary Iron Intake to Combat Anemia

## Good Practices Checklist

*(Note: These steps are presented in a suggested order of implementation.)*

### CHOOSE THE BEST FOODS TO FORTIFY

- Study consumption of iron-containing foods and potential foods for fortification by vulnerable group, geographic location, season, ethnic group, and other national and demographic factors
- For the general and target populations, determine if widely consumed foods meet the criteria for effective fortification
- Consider the availability of “value-added” nonstaple foods for possible targeting to vulnerable groups
- Decide which foods will be fortified and for whom – the entire population or specific vulnerable groups such as young children

### CHOOSE THE APPROPRIATE FORTIFICANT

- Review the different fortificants, including their relative costs, compatibility with food vehicle, absorption, and availability in domestic and international markets
- Decide which and how much fortificant to use

### DETERMINE EFFICACY AND EFFECTIVENESS

- Review information on the efficacy of the fortificant for the chosen food; conduct trials if needed
- Plan to measure effectiveness

### STUDY INDUSTRIAL CAPACITY FOR FOOD FORTIFICATION

- Determine industry’s commitment and capacity to fortify foods in terms of technology, equipment, laboratory availability, and qualified personnel
- Determine availability of (or potential for developing) structures and systems for distributing the fortified foods

### DETERMINE THE MARKETABILITY OF THE FORTIFIED FOOD

- Conduct consumer acceptability tests in different income groups about the fortified food and their motivation for consuming it
- Conduct market analysis to determine the ability and willingness of consumers and industry to pay additional costs of fortification

### ENSURE PROPER PRODUCT PACKAGING, UNIFORMITY, AND STABILITY

- Select packaging and labeling for the product
- Test for uniformity and stability of the fortificant in the manufactured product under environmental conditions over time
- Test-market product stability and packaging with consumers

*(Continued next page)*

## **ESTABLISH NATIONAL GUIDANCE FOR FORTIFYING FOODS AND REGULATING FOOD FORTIFICATION**

- Determine if legislation is desired or needed
- Develop guidance for food fortification
- Ensure that food imports are fortified and comply with regulations
- Increase government capacity to legislate and enforce fortification

## **RAISE SUPPORT FOR FORTIFIED PRODUCTS**

- Motivate and educate consumers and health and food professionals about consuming fortified foods

## **MONITOR AND EVALUATE IRON FORTIFICATION PROGRAMS**

- Monitor consumption of the fortified food by different vulnerable groups
- Develop and expand the food product distribution system

# Improving Dietary Iron Intake to Combat Anemia

## Good Practices in Detail

### Choose the Best Foods to Fortify

- **Study consumption of iron-containing foods and potential foods for fortification by vulnerable group, geographic location, season, ethnic group, and other national and demographic factors**

Program managers and their partners in anemia prevention and control can work with data collection and survey experts to design and conduct food consumption surveys. These surveys should provide information about consumption patterns and how adequately they meet nutritional requirements. This information can then suggest the best foods to fortify, according to which foods are most commonly consumed, when they are consumed, and who consumes them. They can also provide indicators of the need for fortification by geographic location, urban or rural residence, income, season, ethnicity, gender, and age. In determining consumption patterns, it is important to consider whether foods come from animal or plant sources and if they inhibit or enhance absorption of dietary iron. These considerations will help determine the amount of iron needed from fortification. Surveys should be con-

An extensive consumption survey in **Guatemala** determined that maize flour was an appropriate food for the most vulnerable income groups but that the amount of maize consumed, especially by children less than 5 years old, varied considerably by region. Based on regional, cultural, and economic variations within target groups, recommendations were made to fortify foods on a regional rather than national basis.

**Chile** made special efforts to determine what foods children most widely consume, and how much, in order to identify possible foods to fortify.



In Latin America, tortillas made with fortified maize flour increase consumers' iron intake.

ducted during the initial program planning phase (see **Know the problem ...** in **Chapter II**).

- **For the general and target populations, determine if widely consumed foods meet the criteria for effective fortification**

To be a good choice for fortification, a food should:

- Be consumed in all or most meals throughout the year. This will ensure regular iron consumption and also maximize iron absorption, because iron is more efficiently absorbed when available from several meals throughout the day and not just in one meal.
- Be consumed by vulnerable groups in each region of the country
- Be dark in color and/or have a strong taste or odor. These characteristics help mask the effects of iron compounds on foods. Foods with these characteristics can be fortified with less expensive, well-absorbed fortificants that cause undesirable changes in color, taste, and other food qualities.
- Demonstrate good stability in storage, or not require prolonged storage, particularly under hot and humid conditions

- Have patterns of consumption that are unrelated to socioeconomic status
- Be economical to produce and be available for purchase at an affordable price
- Be produced through central processing at relatively few production facilities
- Not interfere with absorption of the fortificant
- Have a low content of inhibitors of iron absorption
- Have a high content of enhancers of iron absorption
- Have a balance of inhibitors and enhancers that maximizes absorption
- Be linked to energy intake (i.e., staple foods)
- Have low risk of being consumed in excess

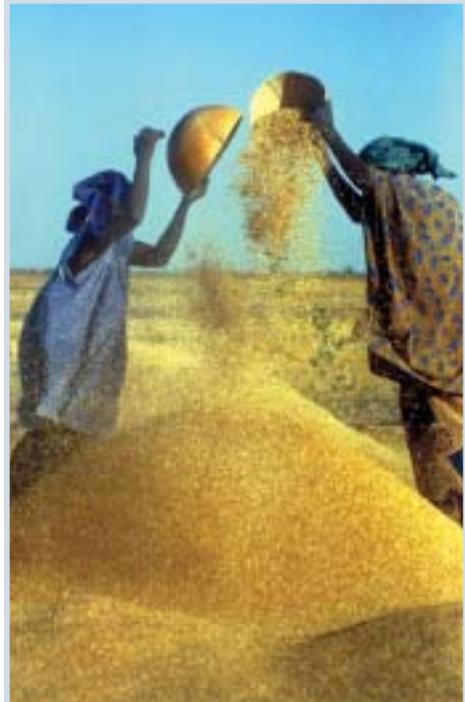
White wheat flour is a good food for fortification because milling removes the bran and germ that contain most of the substances that inhibit iron absorption. Other processes that reduce inhibitors include

In **Egypt**, tests showed that 13.5 percent of the iron in the fortified flour used to make French bread was absorbed, compared to only 8.6 percent of the iron in fortified flour used to make Shami bread. These differences were thought to be due to the higher baking temperature for the French bread. For village-milled flour used to make Baladi bread, only 2.1 percent of the iron was absorbed because of the fortified flour's higher bran content. Absorption increased by 2.5 to 3 times after a more absorbable type of iron was added to the dough before baking.

**Guatemala** identified maize flour as the food most likely to reach low-income groups in rural areas. Maize flour is also fortified in **Mexico** and **Venezuela**.

In **Bahrain, Bolivia, Egypt, Grenada, Iran, Jamaica, Kuwait, Mexico, Oman, Saudi Arabia,** and **Venezuela**, wheat flour is fortified.

The **Philippines** has experimented with and conducted efficacy testing on iron-fortified rice.



Grain products are widely consumed and suitable for fortification in many countries.

fermentation of leavened bread and high-temperature baking. Milling removes iron as well as inhibitors, but fortification replaces this iron and can add more. Industrialized countries have added iron and other micronutrients to wheat flour for decades. Approximately 10 percent of the iron added to fortified white flour may be absorbed by iron-deficient individuals.

Most of the wheat flour used in developing countries is either whole-wheat flour or flour that still contains some of its bran and thus still con-

---

***Tools and Resources contains the table “Substances That Inhibit and Enhance Absorption of Iron.”***

---

tains significant amounts of inhibitors. With these types of flour, iron absorption declines to 4 percent or less. Inhibitors of iron absorption may also be present in other foods consumed during a meal, which will further decrease the amount of iron absorbed.

Maize meal, a staple in many developing countries, also contains inhibitors. Iron-fortified maize meal yields only 1 to 3 percent absorption. When maize meal is fermented or processed with lime, inhibitors are reduced, and iron is absorbed at a higher rate than from white wheat flour. This type of processing is preferred when maize meal will be fortified with iron.

□ **Consider the availability of “value-added” nonstaple foods for possible targeting to vulnerable groups**

Recent efforts to improve the reach of fortification programs have focused on fortifying nonstaple foods that general populations or targeted vulnerable groups particularly like and consume. Fortifying condiments and seasoning products such as sugar, fish sauce, and curry powder can be effective but need to be implemented more widely at a national scale. Fortified cereals targeted at vulnerable groups, mainly young children, have improved iron status in the target groups. Snack foods and breakfast buns are other possibilities. The technology for fortifying salt with both iodine and iron has been improved, and its effectiveness is being tested in several countries (see box **The Potential of Double-Fortified Salt**). Experimentation continues with other condiments and spices as well.

In *China*, the government is testing the efficacy of iron-fortified soy sauce. It is an attractive candidate for fortification because most vulnerable groups consume it as a condiment. In addition, national production is relatively centralized, with just 10 percent of the country's soy sauce manufacturers producing 42 percent of the country's supply.

Bouillon cubes are used throughout *West Africa*, where flour is not widely consumed. It may be possible to fortify them with iron.

In *Argentina*, milk is fortified.

Salt is fortified on a small scale in *India*. Other condiments considered for fortification include sugar in *Guatemala* and *Venezuela* and fish sauce in *Vietnam* and *Thailand*.

In *South Africa*, iron deficiency existed mainly in the Indian population, so iron fortification of curry powder was proposed. Fortification of maize meal is being considered for the general population. Biscuits for schoolchildren have been fortified to reach this vulnerable group.

In *Chile*, a number of foods have been developed to address iron needs in young children. Studies have shown the efficacy of iron-fortified cowmilk-based powdered formula, cookies containing dried bovine blood, and iron-fortified weaning cereals. Anemia prevalence fell from 23 to 4 percent in this population.

*Indonesia* determined that wheat flour used to make noodles could supply 25 percent of young children's iron needs. The government has mandated that all wheat flour be fortified.

Children's foods are fortified in *Argentina*, *Chile*, *Guatemala*, and *Peru*.

□ **Decide which foods will be fortified and for whom – the entire population or specific vulnerable groups such as young children**

Based on the information gathered, the partners in the food fortification program must choose an appropriate food or condiment to fortify based on the needs of the entire population or specific vulnerable groups and the foods that reach them. Foods that can be fortified for children under age 2 need particular attention because of this group's high iron needs (see box **The Special Iron Needs of Children Under Age 2** in *Chapter 1*). The food industry's capacity to fortify, distribute, and monitor the quality and coverage of the food should also be considered.

## Choose the Appropriate Fortificant

□ **Review the different fortificants, including their relative costs, compatibility with food vehicle, absorption, and availability in domestic and international markets**

Food fortification specialists should advise on choosing an appropriate iron com-

## The Potential of Double-Fortified Salt

Because of the commitment of governments and donors, salt iodization has been the most successful fortification program in most developing countries. Salt is an ideal condiment for fortification because it is consumed by all population groups in all cultures. Adding other micronutrients to salt can help address other micronutrient deficiencies. Fortification of salt with iron, in addition to iodine, would reduce iron deficiency and greatly improve iron status in developing countries. Since iron deficiency affects iodine uptake, it makes sense to fortify salt with both iron and iodine.

The technology to double-fortify salt with iodine and iron was developed in India 30 years ago, and one private company continues to produce double-fortified salt. Its effect in reducing anemia was demonstrated in a recent study that found that hemoglobin levels increased from a mean of 8.9 g/dL to 10.2 g/dL in tea pickers in southern India who consumed double-fortified salt. The study also showed that the tea pickers' productivity increased.

Problems with product stability and consumer acceptability have limited the use of double-fortified salt on a larger scale. Researchers are experimenting with a process of encapsulating both the iron and the iodine in the salt to improve its stability and acceptability. This may permit broader promotion and distribution of double-fortified salt worldwide, provided the cost is acceptable to consumers. Initial efficacy trials are promising, but further study is needed to determine the effectiveness of double-fortification of salt on a wide scale.

pound to use as the fortificant. Outside technical assistance may be needed to determine the best fortificant to use in local circumstances.

In choosing the fortificant, a number of factors should be considered, including:

- The amount of iron absorbed and thus its impact on iron status
- Affordability
- Market availability
- Stability when stored over time so that no or minimal changes occur in food taste, smell, and appearance

Very few compounds meet all these criteria, and even the four most commonly used – ferrous sulfate, ferrous fumarate, elemental iron, and sodium iron ethylene diamine tetra-acetate (EDTA) – vary greatly in their cost, absorbability, stability, and effects on food (see box **Comparing Four Commonly Used Fortificants**).

### □ **Decide which and how much fortificant to use**

Program and project managers should consult with food technologists and food chemical suppliers about the relative benefits and limitations of available fortificants

in order to decide about the best ones to use with foods proposed for fortification. Fortificant mixes containing other micronutrients should also be considered, if there are other micronutrient deficiencies that fortification can address.

With input and advice from technical experts or food industry specialists, the amount of fortificant to add to the selected food can be determined by applying the following calculation:

- 1) Estimate the daily per capita iron intake of the targeted population
- 2) Estimate the amount of additional absorbed iron needed to meet the recommended daily dietary allowance
- 3) Estimate the proportion of the recommended dietary allowances for iron to be met by food fortification
- 4) Estimate the amount of the fortified food consumed daily per capita
- 5) Calculate the fortificant level based on additional absorbed iron needed per capita daily consumption, the absorption of the chosen iron fortificant, and the amount of food consumed

## Comparing Four Commonly Used Fortificants

**Ferrous sulfate:** Ferrous sulfate is the iron fortificant against which others are measured. It is relatively inexpensive and well absorbed, dissolving easily in gastric juices. It has some disadvantages, however, such as promoting fat oxidation, which can cause rancidity and changes in food color. Ferrous sulfate is the preferred fortificant for use in baked goods that are stored for relatively short periods (less than three months) and in cool places (temperature less than 30°C). New processes of encapsulating ferrous sulfate to reduce sensory changes are promising, but they require sophisticated technology and are expensive.

**Ferrous fumarate:** Ferrous fumarate is just as absorbable as ferrous sulfate and causes fewer sensory changes. It is more expensive, however. It is often used in blended cereal foods that may require a long shelf life. It is better absorbed in gastric juices than elemental iron compounds, but children, who produce less gastric acid, may not absorb it well.

**Sodium iron ethylene diamine tetra-acetate (EDTA):** Sodium iron EDTA is absorbed two to three times better than ferrous sulfate and does not cause rancidity or changes in food color. It has received approval from the FAO/WHO Codex Alimentarius Joint Committee on Food Additives as safe when used in iron-deficient populations. Sodium iron EDTA has limited application because it is relatively expensive and not widely produced, but it is possible to add disodium EDTA, which is less expensive, to ferrous sulfate and achieve the same advantage of improved iron absorption at lower cost. However, the negative effects of ferrous sulfate on food remain.

**Elemental iron:** Elemental iron has only half the bioavailability of ferrous sulfate. It is less costly and more stable than ferrous sulfate and is probably best suited for flour that is stored for a long time. Of the five types, electrolytic iron is the best absorbed. Its absorption, however, is just half that of ferrous sulfate, so more than twice the amount of electrolytic iron is often used to provide a similar content of absorbable iron. It is thus more expensive over the long term. Many countries use elemental iron, although its impact on iron status is unknown. Programs that are using elemental iron to fortify cereal products should be evaluated to optimize its use or, if necessary, suggest changes to compounds that are better absorbed.

## Determine Efficacy and Effectiveness

### □ Review information on the efficacy of the fortificant for the chosen food; conduct trials if needed

An efficacy trial conducted by a human biologist or nutritionist can ascertain the fortificant's impact on nutritional status in a controlled setting. A trial may also be needed to determine the fortificant's efficacy in the chosen food in the intended population. During the program planning phase, existing information on the fortificant's efficacy from *in vitro*, animal, and human studies should be reviewed. If there is sufficient evidence that the fortificant in the fortified food has the desired impact on nutritional status, a trial is not necessary. If a trial appears necessary, its cost, size, and duration need to be determined and budgeted for in the planning phase.

### □ Plan to measure effectiveness

Measuring the effectiveness of the fortificant by determining its impact on nutritional status in an uncontrolled setting is just as important as showing biological impact in a controlled setting. Program managers should anticipate and include this activity in program planning and budgets. The evaluation of the effectiveness trial should occur once the target audience has been motivated to purchase and consume the fortified food.

## Study Industrial Capacity for Food Fortification

### □ Determine industry's commitment and capacity to fortify foods in terms of technology, equipment, laboratory availability, and qualified personnel

Undertaking food fortification requires

industrial commitment, capacity, and resources, including an adequate level of technology, equipment and laboratories, and qualified technical personnel. Program planners must consult with partners in the food industry to determine its potential to undertake food fortification on a large scale, which can be constrained by a lack of central processing capacity or by limited purchasing power of target populations.

Industry's commitment to food fortification can be strengthened if it realizes that investment in this area will improve its long-term competitiveness. Donors initially may need to help national programs and food industries finance activities that will allow the industries to later increase their food fortification capacity and efforts.

Food fortification also requires industrial equipment and personnel capacity to carry out the technical processes involved with adding fortificants and packaging foods in a way that preserves their nutritional quality. Quality control at the production level is essential to ensure cost containment, consumer satisfaction, and regulatory compliance. Experts in fortification may be needed to help determine and develop industrial and quality control capacity in these areas.

In *Venezuela*, the food industry was educated about the benefits of fortification and then took pride in absorbing the cost of the fortificant as its contribution to national health.

In *Guatemala*, millers were surveyed to determine their interest in and rally their support for fortification.

#### □ **Determine availability of (or potential for developing) structures and systems for distributing the fortified foods**

Food fortification programs must also determine the ability of the food industry and other partners to deliver fortified foods to their intended consumers. Distances between central processing facilities and target populations, transport capacity, and transportation conditions are factors that may affect a program's ability to reach

its target populations. Government and the food industry should also develop standards to ensure that the quality of the fortified food is maintained during distribution. Government agencies responsible for food and drug regulation should be involved in quality control at each level of food distribution, including the household level.

## **Determine the Marketability of the Fortified Food**

#### □ **Conduct consumer acceptability tests in different income groups about the fortified food and their motivation for consuming it**

Program managers and the food industry, with technical assistance from advertising or marketing firms, should work together to design and conduct tests among different income groups to determine the fortified food's acceptability to consumers. These tests should measure the acceptability of the food's taste, texture, color, odor, cooking characteristics, and appearance before and after cooking. Additional information on packaging, labeling, and consumer motivation to purchase and consume the food, including the perceived health value of the product, should be collected.

In *Tunisia*, testing revealed that consumers preferred flour made from locally grown wheat over centrally processed flour because they perceived the local flour as purer, better tasting, more filling, and healthier.

In *Guatemala*, consumer testing ensured product acceptability after fortification.

#### □ **Conduct market analysis to determine the ability and willingness of consumers and industry to pay additional costs of fortification**

The cost of the fortificant is the major cost to food fortification programs. Equipment costs for adding fortificant and costs of quality control tests are considerably lower. The fortificant cost is usually passed on to

the consumer but only increases the price of the fortified food product by 1 percent.

Even so, the cost of fortification can be significant for large volumes of food. Either the food company absorbs these costs out of its profits, or consumers pay higher prices to cover them. Because food industries often have a low profit margin to begin with, it may not be realistic to expect them to pay for the additional cost of fortificant. Governments or donors can initially subsidize costs and waive tariffs on equipment and fortificant, but experience shows that programs will not be sustainable until consumers cover these costs.

To determine if millers, other producers, or consumers of different income levels are able to bear the added costs of fortification, program managers should arrange to survey each involved group about its ability and willingness to pay extra (and how much extra). It is important to determine how the product can be made available to consumers who cannot afford to buy it.

In a survey in *Thailand*, few rice millers believed that consumers would pay a higher price for a fortified product. However, in a survey of consumers, one-third of respondents said they would pay more for a product of good quality. To encourage the private sector to fortify foods, the government reduced taxes on fortification equipment and supplies and simplified registration of new foods.

In *Indonesia*, donors covered fortificant costs for wheat flour fortification for several years.

In *Venezuela*, the government and nutrition specialists convinced the private sector to recognize the problem of iron deficiency and to pay fortificant costs.

## Ensure Proper Product Packaging, Uniformity, and Stability

### □ Select packaging and labeling for the product

Appropriate packaging that ensures an adequate shelf life and accurate labeling

(including, if possible, seals of approval from government agencies) are essential to the success of food fortification programs. Experts in the areas of packaging and labeling should help design new packaging or conduct an analysis of current packaging and suggest changes, if needed.

### □ Test for uniformity and stability of the fortificant in the manufactured product under environmental conditions over time

Industry and government should work together to monitor the manufactured product, industry at the production level and government inspectors at the retail and household levels. The fortificant must be uniformly distributed in the final packaged product. The food industry's quality control systems can

confirm that the manufacturing line

***“Food Fortification: Seven Steps for Quality Control” can be found in Tools and Resources.***

is functioning properly to ensure this uniformity. The stability of the fortificant in the packaged product and its effect on iron content and product color, taste, odor, and texture must also be evaluated to ensure an acceptable shelf life in warehouses, stores, and households. Samples need to be kept in appropriate conditions and tested at regular intervals.

In *Grenada*, the quality of flour was monitored at the retail and consumer levels. Specialists assessed quality control at the factory level and iron content of flour at different delivery levels.

### □ Test-market product stability and packaging with consumers

After testing the uniformity and stability of the fortificant in the fortified product, the next step is to test product stability as it is packaged for consumer use. These steps are often conducted separately because the findings of the fortificant testing will affect the choice of packaging. Effectiveness trials to test the impact of the fortified food in

households can include testing the effectiveness of product packaging. Research should also determine if consumers understand labels and the information they provide about nutrition and proper storage, preparation, and serving of the fortified food.

## Establish National Guidance for Fortifying Foods and Regulating Food Fortification

### □ Determine if legislation is desired or needed

Food fortification can be voluntary or mandatory. Mandatory fortification is generally the most desirable approach for achieving the highest and broadest impact in terms of reducing iron-deficiency anemia. However, voluntary fortification can serve a useful purpose; it gives companies a transition period to make the necessary adjustments in their production processes and also allows forward-looking food producers to gain market share by moving to food fortification before their competitors. If voluntary or permissive fortification is established, it should be for a fixed period, after which mandatory fortification is required.

Program managers should work with representatives of government food regulatory agencies and industry to develop the necessary guidance and policies on fortifying foods and regulating food fortification. In some cases, non-binding guidance from government agencies may accomplish as much as legislation. If standards are to be enforced nationwide, legislation may be necessary. In some situations, however, it may be better to have a general umbrella food law and establish fortification as a regulation.

### □ Develop guidance for food fortification

Government norms and regulations for food fortification must be consistently followed and enforced. Guidance on

fortification should give information to the food industry about the level of fortification, acceptable foods, acceptable ranges of nutrients, and how to measure levels of nutrients. Producers will also need guidance on what constitutes compliance or noncompliance with norms and regulations. If fortification is voluntary, monitoring compliance may be impractical, especially in countries with many small millers or producers.

When government makes fortification mandatory, procuring the fortificant through commercial channels is optimal. Guidance for public procurement systems should emphasize transparency, accountability, and speed, as well as the need to ensure that all millers are supplied with the proper amount of fortificant.

### □ Ensure that food imports are fortified and comply with regulations

Government customs agents are responsible for overseeing food imports and ensuring that fortification regulations are followed. To do this, they need to be informed of requirements and trained and equipped to ensure that imported foods meet them. Good relations with other countries are helpful for controlling legal and illegal imports of unfortified foods and protecting consumers and industries that are fortifying their products.

For imported foods, including food aid, the exporting countries should be required to deliver fortified products. These foods need to be monitored by the exporter or donor for quality. This is more cost-effective and easier to control, administer, and finance than adding iron to food when it arrives in the country. It also protects

*Bolivia* improved regulatory systems so that all imported food met legislative criteria and contraband was minimized.

In *Central America*, the *Middle East*, and *North Africa*, industries and governments have worked together to ensure that food producers in these regions follow the same standards and regulations.

## Raise Support for Fortified Products

indigenous companies committed to fortification from competition from unfortified cheaper products. However, if whole grains are imported and processed in country, the food needs to be fortified in country during processing, and the exporter or donor should be responsible for ensuring this occurs.

### □ Increase government capacity to legislate and enforce fortification

Governments can do a number of things to enforce fortification:

- Validate quality control systems at plants
- Conduct spot checks through laboratory analysis of food samples from production facilities, markets, and retail outlets to examine fortificant levels, product stability, and food appearance and taste
- Inform the public about the quality of the fortified food
- Establish procedures for fining or closing food plants that do not comply with regulations
- Register and act on consumer complaints about products
- In countries where industries are “self-regulating,” verify that self-regulation is working and that food is adequately fortified
- Establish and maintain good relations with other countries and support regional initiatives to control imports of unfortified foods

Building the capacity of government to regulate and enforce legislation is one of the most challenging aspects of fortification. The different players involved in making regulation and enforcement successful include government, industry, and consumer groups. This effort may also require modifications to existing infrastructure, including creating positions at each level to monitor and regulate fortified foods.

In *Central America*, quality monitoring was improved to assist in enforcement.

### □ Motivate and educate consumers and health and food professionals about consuming fortified foods

Market research and analysis can determine barriers to and facilitators of acceptance and consumption of fortified foods and provide information on consumer needs and preferences. Some of this information may already be available from research conducted early in the process of developing an anemia prevention and control strategy (see **Know the problem ... in Chapter II**).

Advocacy, education, and marketing campaigns can use such information to raise awareness, prompt behavior change, and influence consumer purchasing. Consumers should be informed when foods are fortified; it is especially important to tell them of the benefits of fortified foods to ensure that fears about tainted foods do not undermine the fortification program. Raising awareness among politicians and public health and food officials about the dangers of iron-deficiency anemia and the benefits and safety of fortified foods can only enhance the promotion and acceptability of the fortified food (see **Raise awareness ... in Chapter II**).

*Indonesia* carried out promotional campaigns to dispel public worries about iron in fortified foods.

In general, the government will motivate consumers to buy iron-fortified products, while private companies will advertise their own brand-name iron-fortified products following government guidelines about health claims for the product.

## Monitor and Evaluate Iron Fortification Programs

### □ Monitor consumption of the fortified food by different vulnerable groups

Monitoring and evaluation activities and indicators should be designed and incorporated into fortification programs from the outset. Anemia prevalence is the most

*“Selected Monitoring and Evaluation Indicators for Anemia Prevention and Control Programs” in Tools and Resources includes indicators for monitoring and evaluating food fortification programs.*

appropriate indicator of the impact of anemia prevention and control

programs. Population-level changes in iron deficiency are the best indicators of the impact of food fortification with iron, but measuring these changes is expensive and not appropriate in a field setting. Collecting information about iron status in smaller subpopulations may be possible, however.

Government and industry monitoring of the consumption of fortified products by different vulnerable groups is essential. Data about the amount of iron in foods consumed can be collected, if desired, although this may be expensive. Collecting data about sales volume and locations also provides useful information and is easier and less expensive. Indicators of program impacts, as well as changing consumer habits and the evolving health profile of the population, may dictate modifications in the fortificant levels of the

**Chile** has several decades of experience with food fortification programs that have added iron to staple foods and reduced iron deficiency in the general population. Extensive research has also identified appropriate foods to fortify in order to address iron deficiency in children. Monitoring and evaluating the changes in iron deficiency in children generated by these efforts has been part of the country's strategy to control iron deficiency.

fortified foods (see **Develop a monitoring and evaluation plan ...** in *Chapter II*).

### □ Develop and expand the food product distribution system

Ongoing monitoring of the market for fortified foods can confirm if there is continuing demand and that the fortified food program is sustainable. Government and industry representatives should ensure that such information is shared with program managers.

Based on the changing perceptions and needs of consumers, new messages may need to be developed to sustain demand. This monitoring can be conducted through market research evaluation. If the evaluation confirms sustained demand for the food, private industry should be encouraged to plan for expanded product distribution.

## Photo and Illustration Credits

---

Cover	<b>P. Bennett/IDRC (top), D. Sing/IDRC (middle), D. Marchand/IDRC (bottom)</b>
p. 14	<b>Armando Waak/WHO</b>
p. 23	<b>Longfils/GTZ, Kampot, Cambodia</b>
p. 31	<b>BASICS</b>
p. 36	<b>International Institute of Nutrition, Peru</b>
p. 37	<b>C. Lengeler</b>
p. 38	<b>MotherCare Project/ University of Indonesia/PATH</b>
p. 40	<b>Rae Galloway</b>
p. 43	<b>Antoinette Tisa</b>
p. 50	<b>USAID</b>
p. 52	<b>WHO</b>
p. 53	<b>Atención Integral a la Niñez, Honduras</b>
p. 54	<b>MotherCare and OMNI Projects, Bolivia</b>
p. 57	<b>D. Marchand/IDRC</b>
p. 63	<b>Jim Stipe/Lutheran World Relief</b>
p. 64	<b>Maggie Murray-Lee/Lutheran World Relief</b>



