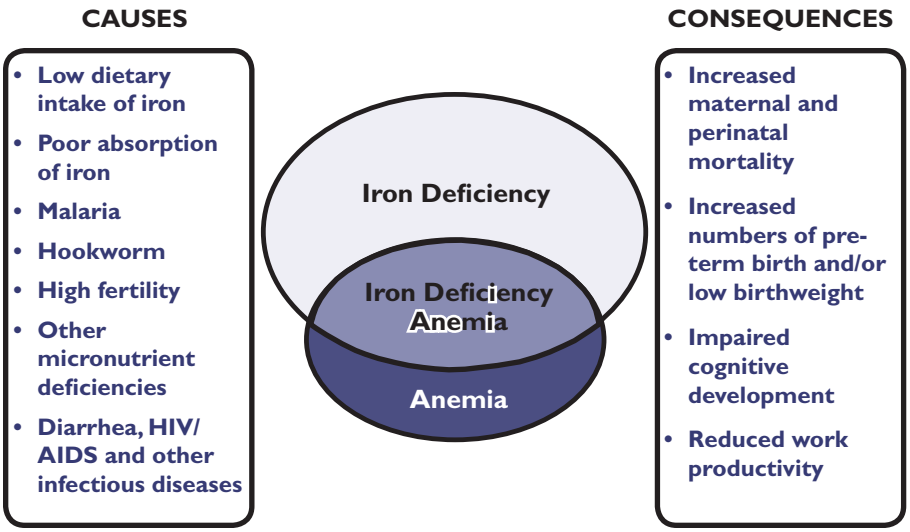
Maternal Anemia: A Preventable Killer

Iron deficiency is one of the most prevalent nutritional deficiencies in the world and is reported by the World Health Organization (WHO) to affect four to five billion people. WHO estimates that two billion people suffer from anemia. Approximately 50% of all anemia is estimated to be due to iron deficiency, a condition of deteriorating iron reserves in the body caused by low dietary intake of iron, poor absorption of dietary iron, or blood loss (for example, from hookworm, repeated childbirth or heavy menstruation) which leads to loss of iron. Iron deficiency anemia (IDA) is the most severe form of iron deficiency, and results when the body's iron supply cannot support production of hemoglobin in adequate amounts to maintain normal functioning of the body. Anemia from other causes (and therefore, not *iron deficiency* anemia), results from malaria or from genetic disorders, among other causes. Other micronutrient deficiencies (e.g., vitamins A, B6 and B12, riboflavin, and folic acid) are also known to cause anemia (Figure 1).

Figure 1: Iron deficiency, iron deficiency anemia (IDA) and anemia



Anemia and iron deficiency remain at epidemic levels among women and children in many nations. Given the availability of proven interventions to prevent and treat anemia caused by a variety of determinants, the persistent high prevalence represent a lack of political will and failure of the public health sector. New estimates of the numbers of maternal and perinatal deaths associated with iron deficiency anemia underscore the urgent need to refocus resources and public health priorities to more effectively tackle the problem.

1. Anemia and iron deficiency are highly prevalent conditions with major consequences for health, survival, and economic development

Anemia prevalence is highest among pregnant women, infants, and young children due to the high iron demands of growth and pregnancy. On average, 45% of pregnant women and 49% of chidren under five years of age are anemic in developing regions.[1] The consequences of anemia include:

- Increased maternal and perinatal mortality
- Increased numbers of preterm birth and/or low birthweight
- Impaired cognitive development in children
- Reduced adult work productivity

Hence, anemia prevention programs can contribute significantly to achieving many of the Millennium Development Goals (MDGs) including MDGs 1 (Poverty and hunger); 2 (Universal education); 4 (Child mortality reduction); and 5 (Improved maternal health).

Iron is critical to oxygen transport in the body

In the human body, iron is present in all cells and has several vital functions—as a carrier of oxygen to the tissues from the lungs in the form of hemoglobin (Hb); as a facilitator of oxygen use and storage in the muscles as myoglobin and as an integral part of enzymes. Anemia is defined as a low level of Hb in blood.

2. Iron deficiency is high on the list of risk factors for global maternal and perinatal mortality

WHO's 2002 *Global Burden of Disease Report* identified iron deficiency as the 12th most important risk factor for all mortality globally, and the 9th most important risk factor for the

[1] Mason, Rivers and Helwig. "Recent trends in malnutrition in developing regions: Vitamin A deficiencies, anemia, iodine deficiency, and child underweight," *Food and Nutrition Bulletin* 26: 57-162, 2005.

global burden of disease. Recent WHO analysis of causes of maternal death showed that hemorrhage is the major contributor to maternal deaths in developing countries.[2]

In a separate analysis, iron deficiency anemia (IDA) was an underlying risk factor for maternal and perinatal mortality and morbidity, and was estimated to be associated with 115,000 of the 510,000 maternal deaths (22%) and 591,000 of the 2,464,000 perinatal deaths (24%) occurring annually around the world (Figure 2). [3, 4]

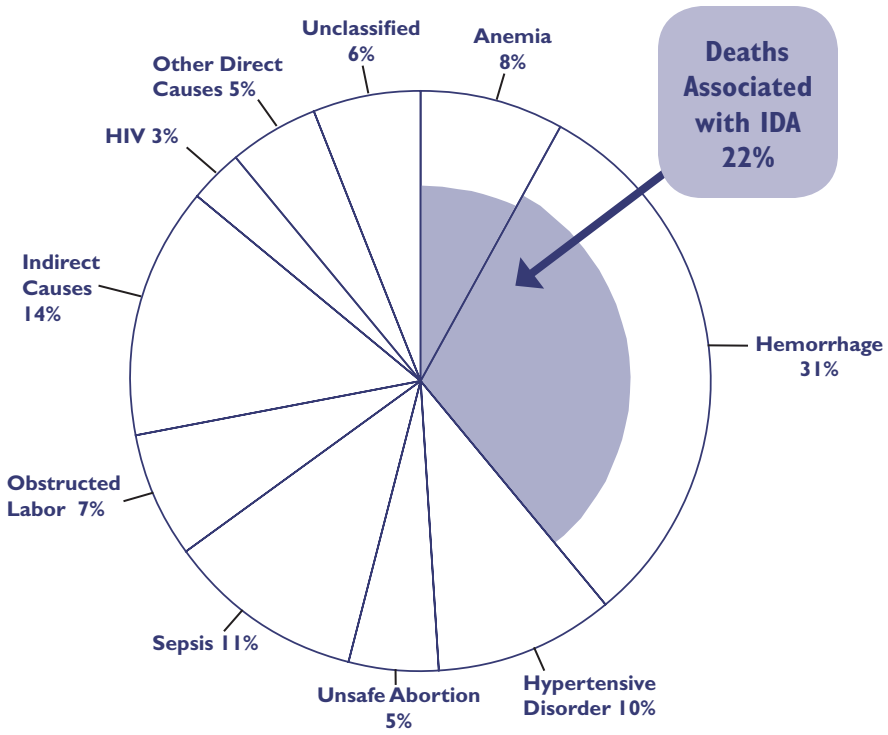
The consequences of anemia are serious:

- Anemia in pregnant women reduces a woman's ability to survive bleeding during and after childbirth (i.e., post partum hemorrhage (PPH)) and may result in premature and/or lower birthweight babies with a higher risk of death
- Iron deficiency with or without anemia limits cognitive development in children. It reduces their achievement in school and ultimately undercuts the benefits of investing in education.
- Anemia and iron deficiency cause weakness, fatigue, and reduced physical ability to work. Economic analysis show that for every $1 spent on iron supplementation programs for pregnant women, there is a return of US $24 in decreased disability and increased wages over a woman's lifetime.[4]

Anemia/low hemoglobin creates cardiovascular problems

Underpinning the relationship between hemoglobin concentration and mortality risk is the fact that death from cardiovascular causes is a function of blood volume, blood loss, cardiac fitness, and hemoglobin concentration.

Figure 2. Causes of Maternal Death[2] and Contribution of Iron Deficiency Anemia (IDA)[3]



3. New analyses show that mild and moderate – not just severe – anemia has serious consequences for women and children

A recent meta-analysis[3] shows that correcting anemia of ***any*** severity reduces the risk of death: **the risk of maternal mortality decreases by about 20% for each 1 g/dL increase in Hb**. This decreased risk is continuous over the full range of Hb between 5 and 12 but it is not linear — the decrease in risk is greater at the lower Hb concentrations. This is a new finding and different from the earlier view that only severe anemia is associated with increased mortality. It has important policy and program implications:

More women are affected by increased mortality risk. Previous estimates of the number of women at increased risk of death associated with anemia only considered those women with severe anemia. In light of the meta-analysis results, more pregnant women are estimated to be at risk, since the majority of anemic women have hemoglobin concentrations between 7 and 12 g/dL (mild and moderate anemia) compared to the relative few with severe (Hb < 7 g/dL) or very severe anemia (Hb < 5 g/dL). Hence programs should focus on mild and moderate anemia, in addition to severe anemia, for **public health impact**.

[2] Calculated from "WHO Analysis of Causes of Maternal Deaths: A Systematic Review," *The Lancet* 367: 1066-1074, 2006.
[3] Stoltzfus, Mullany and Black. *Iron Deficiency Anemia,* "Comparative quantification of health risks: Global and regional burden of disease attributable to selected major risk factors," WHO 2004.
[4] Based on the quantitative relationship, one can estimate the percent of maternal mortality attributable to iron deficiency anemia (IDA) in a given country when maternal mortality ratio, prevalence of anemia, and number of births per year are known (PROFILES, IDA Calculator at www.fantaproject.org).

4. Knowing the various causes of anemia in a target population is the first step in designing tailored intervention strategies

The main causes of anemia include:

- inadequate intake and poor absorption of iron
- malaria, particularly in young children and pregnant women
- hookworms
- diarrhea, HIV/AIDS and other infections
- genetic disorders (e.g., sickle cell and thalassemia)
- blood loss during labor and delivery; heavy menstrual blood flow; closely spaced pregnancies

Table 1 below highlights the relative importance of these causes by region. The relative importance of various causes differs by age and sex of the population and setting. The greatest burden of death and disease due to anemia is in Africa and Asia and is associated with the consequences of anemia among pregnant women and young children.

5. Proven interventions are available to address the major causes of anemia in women

There is consensus on a number of evidence-based interventions to reduce anemia prevalence among pregnant women/women of reproductive age when they are applied effectively to a population with known causes of anemia.

- Universal supplementation of pregnant women with daily iron folic acid tablets;[6]
- Fortification of commonly consumed food products with micronutrients;[7]
- Control of malaria by intermittent preventive treatment (IPT), long-lasting insecticide treated bed nets (ITN), indoor residual spraying (IRS), and Artemisinin-Containing Antimalarial Combination Therapy (ACT);[8]
- Control of hookworms by deworming medication such as albendazole and mebendazole as a routine part of ANC where hookworm prevalence >20%;[9]
- Optimal birth spacing;[10] and
- Programs that improve the iron stores of adolescents with weekly iron/folic acid supplements.[11]

6. Maternal anemia programs are most effective when they address the multiple causes of anemia through integrated interventions[12]

Programs need to address the primary preventable causes of anemia in a coordinated way. The global Roll Back Malaria initiative has worked in tandem with maternal health and safe motherhood programs since 1998 to prevent and control anemia caused by malaria in pregnant women through integrated program interventions. Efforts to address maternal anemia should be tailored to the local context and situation and take advantage of partnerships with agencies and programs that are implementing relevant interventions. Presently, there are several global initiatives that focus on prevention of anemia:

- The Global Alliance for Improved Nutrition (GAIN – a fortification initiative at www.gainhealth.org)
- The Presidential Malaria Initiatives (PMI, www.fightmalaria.gov)
- Partners for Parasite Control (www.who.wormcontrol/en/)
- Global Fund for AIDS, Tuberculosis and Malaria (www.globalfund.org)
- President's Emergency Plan for AIDS Relief (www.state.gov/s/gac)

Table 1: Causes of Anemia - Relative Importance by Region

	Iron Deficiency	Malaria	Hookworm	High Fertility	HIV/AIDS
Sub-Saharan Africa	●	●	❖	●	❖
South and SouthEast Asia	●	❖	▼	❖	▼
North Africa	●	▼	▼	❖	▼
Americas	●	▼	▼	▼	▼
Central Asia/Caucasus	●	❖	▼	❖	▼
Western Pacific (includes China)	●	▼	❖	▼	▼

Relative Importance by Region Key:

● high

❖ medium

▼ low

Adapted from: Galloway, R. *Anemia Prevention and Control: What Works*. Washington, DC: USAID, June 2003.

[6] Yip. "Iron supplementation during pregnancy: Is it effective?" *American Journal of Clinical Nutrition* 63: 835-855, 1996.
[7] Mannar and Gallego. "Iron fortification: Country level experiences and lessons learned," *Journal of Nutrition* 132:856S-858S, 2002.
[8] Strategic framework for malaria control during pregnancy in the WHO Africa region. WHO 2003.
[9] "Report of the WHO Informal Consultation on Hookworm Infection and Anemia in Girls and Women," WHO, 1996.
[10] Conde-Agudelo and Belizan. "Maternal morbidity and mortality associated with interpregnancy interval: Cross sectional study," *British Medical Journal* 321: 1255-1259, 2000.
[11] Soekarjo, de Pee, Kusin and Bloem. "School-based supplementation: Lessons learned in Indonesia," *Standing Committee on Nutrition News* 31, 2005.
[12] Abel, Rajaratnam, Kalaimani and Kirubakaran. "Can iron status be improved in each of the three trimesters? A community-based study." *European Journal of Clinical Nutrition* 54: 490-493, 2002.

USAID health and nutrition programs that address maternal anemia include:

- A2Z Micronutrient and Child Blindness Project,
- Access to Clinical and Community Maternal, Neonatal, and Women's Health Services (ACCESS) Program, and
- Food and Nutrition Technical Assistance (FANTA) Project.

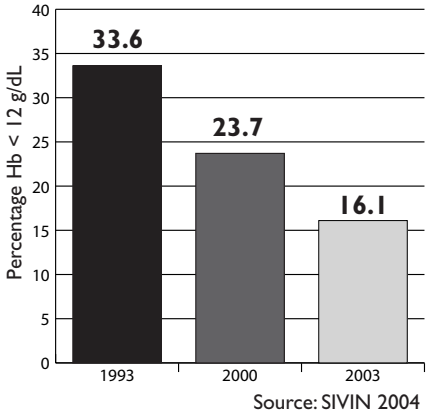
7. Success with national level anemia prevention programs has been documented

In **Nicaragua** the prevalence of anemia in reproductive-age women steadily decreased from 1993 to 2003, going from 34% to 16% (Figure 3). Hallmarks of the Nicaragua anemia prevention program included the following

- Iron was distributed through antenatal care (ANC) clinics and community volunteers did follow-up and counseling work to support women.
- Supplies of iron/folic acid supplements (IFA) were adequate and a strong behavior change communication (BCC) program was implemented.
- 87% of women reported taking IFA in their last pregnancy, and of those who took IFA, 53% took it for longer than 6 months.
- Side-effects were not reported as a major issue. Women were counseled to expect side-effects and reported knowing how to cope with them.
- Universal wheat flour fortification was introduced in 1997; the introduction of vitamin A sugar fortification may have also contributed to anemia reduction.

India recently intensified its anemia control programs for adolescent girls, ages 10 to 19 years, in seven states. Diets with low bioavailable iron combined with helminth infections are the main causes of anemia among girls and women in India.[13] After one year of program implementation, anemia prevalence decreased in all states, varying from reductions of 5 percentage points in Jharkhand to 50 percentage points in Uttar Pradesh. In Andra Pradesh, anemia prevalence decreased 43 percentage points at one year and 70 percentage points after two years of the program implementation.

FIGURE 3. Nicaragua: Prevalence of anemia in mothers/caregivers 1993, 2000 & 2003



Source: SIVIN 2004

The components of the anemia programs included:

- Weekly IFA
- Abendazole to treat worm infestation
- Behavior change communication that covered the importance of nutrition including the intake of iron/folic acid tablets

8. Progress of anemia programs is being monitored

To monitor the progress of anemia programs at the national level, the Demographic and Health Survey (DHS) has been collecting data on anemia prevalence and coverage of iron supplementation during pregnancy since the mid-1990s. DHS also collects data on malaria programs, such as ITN use, use of IPT by pregnant women and starting in 2006, DHS will also obtain information on the use of drugs for intestinal worms. Combined data on these indicators will assist countries to assess and improve anemia prevention and control programs.

Information on the following key indicators is available for selected countries from DHS:

- Anemia prevalence among children and women of reproductive age
- Iron supplementation during pregnancy
- Use of ITN by children and pregnant women
- Use of IPT by pregnant women
- Use of deworming drugs among children and pregnant women

Moving forward with a package of proven interventions to prevent and control maternal anemia

It is clear from experiences that countries implementing a package of proven interventions are much more likely to succeed in improving maternal anemia than countries implementing any one of the single interventions. Hence countries are encouraged to plan for an integrated package of interventions that may include iron supplementation of pregnant women and adolescent girls, fortification of food with iron, malaria and hookworm control and optimal birth spacing as appropriate.

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[13] Dwidedi and Schultink. "Reducing anemia among Indian adolescent girls through once-weekly supplementation with iron and folic acid," *SCN News* 31:19-23, 2006.